

**Human and Organizational Issues in the Army After Next:
A Conference Held 13-15 November 1997**

Michael Drillings
U.S. Army Research Institute

Leonard Adelman and Angel Manzo
George Mason University

Michael D. Shaler
Military Family Institute, Marywood University

Research and Advanced Concepts Office
Michael Drillings, Chief

November 1998



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**U.S. Army Research Institute
for the Behavioral and Social Sciences**

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Human and Organizational Issues in the Army After Next

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Knowledge and Speed by BG E. Buckley

An Ethos-Directed Army for the 21st Century by Dr. Cathy Downes

Chapter III - Leadership

Military Leadership Into the 21st Century: "Another Bridge Too Far?"

by LTG (Ret.) W. Ulmer

Practical Intelligence: Its Contribution to Predicting and Facilitating the

Development of Advanced Levels of Performance by Dr. R. Wagner

Developing Collective Knowledge In Temporary Teams: Challenges For

Military Leadership In The Age Of Mediated Communication

by Dr. S. Weisband

Ethical Leadership: Leadership for All Seasons by COL (Ret.) K. Frey

Leadership in the AAN by Dr. B. Bass

Chapter IV - Training and Education

Technology for Future Naval Forces: The United States Navy

and Marine Corps, 2000-2035 by Dr. D. Fletcher

The Future of Educational Technology in Retrospect by Dr. R. Nickerson

Shared Virtual Environments for Mission Planning and Team Training

by Dr. B. Loftin

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Chapter V - Personnel and Quality of Life

Application of SOF Selection and Assessment Procedures to AAN

by Dr. M. Sanders

Warfighter Biomedical Status Monitoring in Support of AAN Operations

by COL G. Belenky

The AAN: Lesson Learned in American Business by Dr. M. Tenopyr

"Soldierization" for the AAN by Dr. D. Segal

Chapter VI - Organizational Structure and Information

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Human Behavior Modeling and Simulation in Support of the AAN

by Dr. R. Pew

Battle Command of 2020 and Beyond by BG (Ret.) H. Wass de Czege

Cognitively Engineering Technology for the AAN by Dr. L. Adelman

Chapter VII - Small Teams

Small Unit Leadership in Elite Units by LTC J. Galland

Cohesion in a Smaller, More Diverse Military by Dr. L. Miller

Fostering Military Team Adaptability in the AAN by S. Zaccaro

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Prepared by:

Michael Drillings
Research and Advanced Concepts Office
U.S. Army Research Institute

Leonard Adelman and Angel Manzo
Dept. of Operations Research & Engineering
George Mason University

Michael D. Shaler
Military Family Institute
Marywood University

Prepared for

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U.S. Army Research Institute for the Behavioral and Social Sciences
5001 Eisenhower Avenue
Alexandria, VA 22333-5600

January 1998

Human and Organizational Issues in the Army After Next

Agenda

Start	Ends	Activity
Thursday		13 November
1700	1710	Welcome: Dr. E. M. Johnson, ARI
1710	1715	General Information: Dr. M. Drillings, ARI
1715	1800	LTG F. E. Vollrath, DCSPER: "Human Resource Implications for AAN"
1800	1920	Dinner
1930	2030	MG David Ohle, ADCSPER: "OPMS XXI and AAN"
2030	2045	Meeting for Workgroup Facilitators and Recorders- Dr. Drillings
Friday		14 November
0700	0800	Breakfast
0815	0825	Announcements: Dr. M. Drillings, ARI
0825	0930	BG E. Buckley, DCSDOC, TRADOC: "Knowledge and Speed"
0930	1000	LTG (Ret) Walt Ulmer: "Military Leadership into the 21 st Century: Another Bridge too Far"
1000	1030	Dr. Dexter Fletcher, IDA: "Technology for Future Naval Forces: 2000-2035"
1030	1050	Break
1050	1140	Dr. Bowen Loftin, University of Houston: "Shared Virtual Environments for Mission Planning and Team Training"
1140	1240	Lunch
1240	1310	Dr. M. Drillings, ARI: Summaries of Workgroup Papers
1310	1320	Instructions for Workgroups: Dr. M. Drillings
1320	1340	Break
1340	1750	Workgroups – Presentation of papers and discussion
1800	1930	Dinner
1935	2035	BG J. Dubik, ADCSOPS-TR: "Human Dimensions of AAN"
Saturday		15 November
0800	0855	Breakfast
0900	1100	Workgroup discussions
1100	1210	Dr. Cathy Downes, NZ: "An Ethos-Directed Army for the 21 st Century"
1210	1300	Lunch
1300	1345	Workgroups – Preparation of Report Comments
1345	1500	Reports from the Workgroups
1500	1510	Dr. E. M. Johnson, ARI: Closing comments

Workgroup Members

Leadership Workgroup:

COL (Ret) M. Shaler, Facilitator
Dr. P. Gade, Recorder
LTG (Ret) Ulmer
MG D. Ohle
Dr. R. Wagner
Dr. S. Weisband
Dr. B. Bass
COL (Ret) K. Frey
COL Brady
MAJ Bruno
MAJ Echevarria
MAJ Swicord
Dr. D. Leedom
LTC Simpson
Dr. R. Klimoski
Dr. P. Berenson

Dr. M. Tenopyr
COL Payne
COL Stamilo
COL Murray
MAJ Stehlik
SGM Nunley
MAJ Hoffman
Dr. R. Holz
Dr. Winkler

Training and Education:

Dr. S. Graham, Facilitator
Dr. R. Depontbriand, Recorder
MG Garrett
BG Hagenbeck
BG Dubik
Dr. Hiller
Dr. R. Nickerson
Dr. B. Loftin
LTG (Ret) F. Brown
COL Hayes
COL Jacobs
LTC Hahn
Mr. J. Buckley

Organizational Structure and Information:

Dr. L. Adelman, Facilitator
Dr. T. Killion, Recorder
BG Simms
Dr. Z. Simutis
Dr. G. Klein
Dr. P. Lehner
Dr. R. Pew
BG (Ret) H. Wass de Czege
COL Moore
COL Monje
LTC Faires
MAJ Biever
MAJ Riddle
Dr. B. Smith

Small Teams:

Dr. S. Zaccaro, Facilitator
Dr. M. Drillings, Recorder
BG Melton
BG McWilliams
Dr. E. Johnson
COL Gay
LTC J. Galland
SGM Strickland
Dr. D. Fletcher
Dr. L. Miller
COL Lewis
LTC Ballard

Personnel and Quality of Life:

Dr. M. Sanders, Facilitator
Dr. N. Verdugo, Recorder
LTG Vollrath
MG Dean
BG Smith
COL G. Belenky

Workshop Presentations

Plenary Speakers:

LTG F.E. Vollrath: Human Resource Implications of AAN

MG D. Ohle: OPMS XXI and AAN

BG E. Buckley: Knowledge and Speed

BG J. Dubik: Human Dimensions of Army After Next

Dr. Cathy Downes: An Ethos-Directed Army for the 21st Century

Leadership:

LTG (R) W. Ulmer: Military Leadership Into the 21st Century: Another "Bridge Too Far?"

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Small Teams:

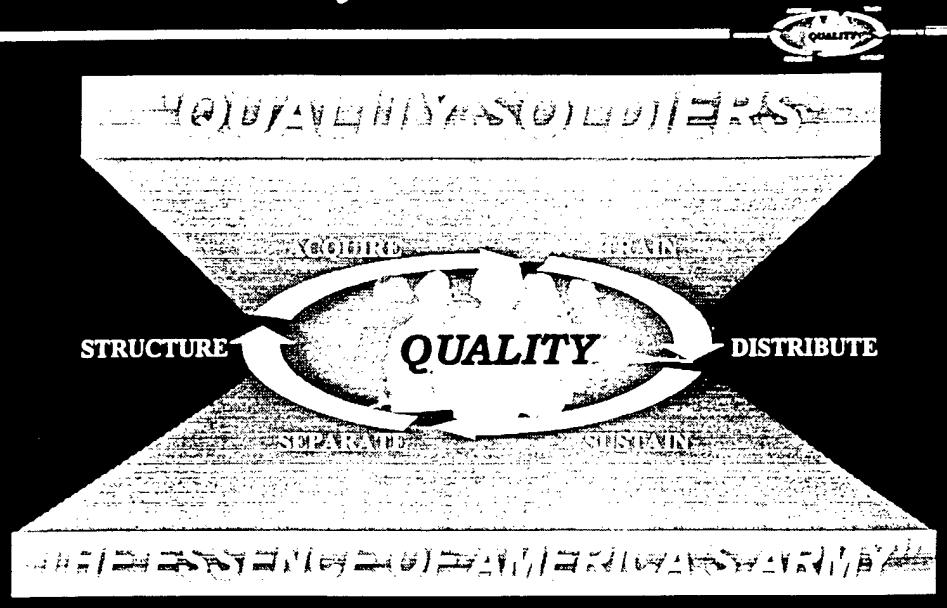
LTC J. Galland: Small Unit Leadership in Elite Units

Dr. L. Miller: Cohesion in a Smaller, More Diverse Military

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LTG F.E. VOLLRATH

America's Army



Quality Soldier: The Essence Of America's Army

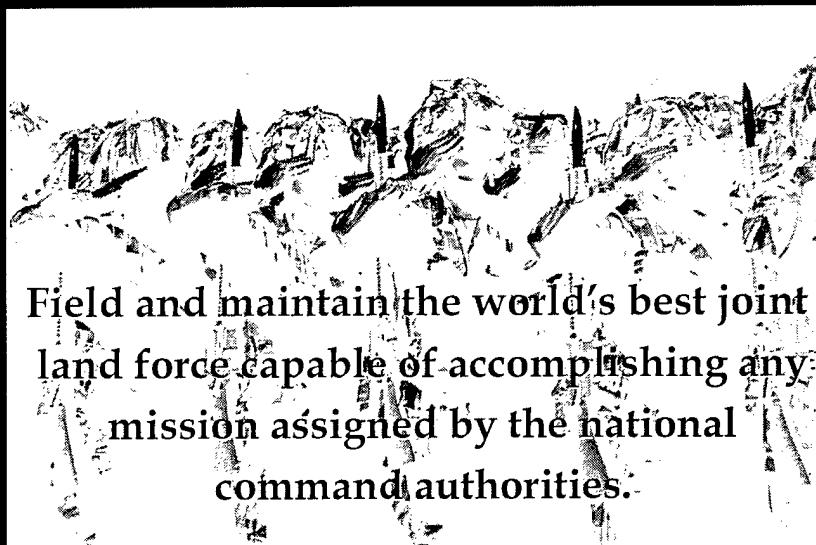
HR Implications of the AAN

- Army Mission, Vision, and Imperatives
- Human Dimension of Change
- DCSPER Vision
- Future Implications
- Moving in that Direction



Quality Soldier: The Essence Of America's Army

Army Mission



Field and maintain the world's best joint land force capable of accomplishing any mission assigned by the national command authorities.

Quality Soldiers: The Essence Of America's Army

The Army Vision



- Evolve through change in doctrine, training and leader development while firmly grounded in values, traditions, and heritage.
- Team with industry and academic communities.
- Leverage information age technologies.
- Employ technically advanced, operationally simple systems.
- Field a capabilities-based force consisting of dedicated and qualified men and women, military and civilian, in both the AC and RC.
- Deploy across the full spectrum as a part of a joint warfighting team.

Quality Soldiers: The Essence Of America's Army

Army Imperatives - How We Synchronize



- Quality People
- Doctrine
- Force Mix
- Modern Equipment
- Training
- Leader Development



Quality Soldiers: The Essence Of America's Army

The Human Dimension of Change



'89 '92 '95 → 2000 2010 2025



Doctrine
Training
Organization
Material

FORCE → FORCE 2.0 → FORCE 3.0 → ARMY → FORCE 2.0 → FORCE 3.0 → ARMY

AOE
Leader Development
Soldier Systems

STRUCTURE
SEPARATE
ACQUIRE
TRAIN
AXXI
DISTRIBUTE
SUSTAIN

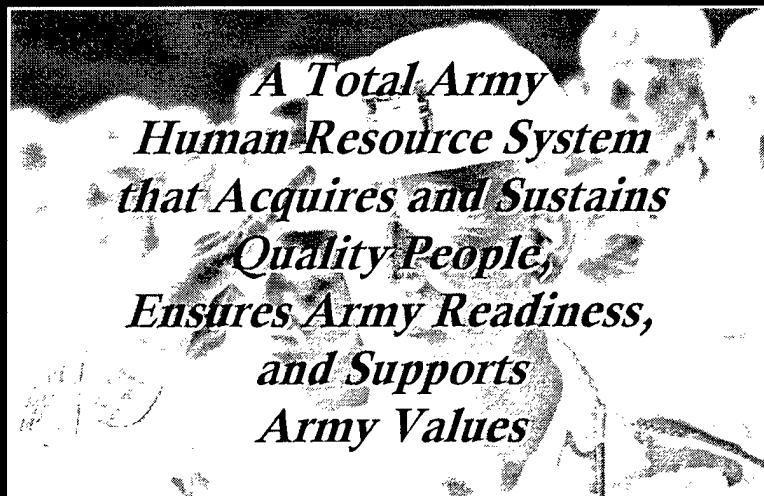
AAN
ARMY

Shaping the Force
Human Relations
Leader Development

Human Resource Dimension

Quality Soldiers: The Essence Of America's Army

DCS PER Vision



Quality Soldiers: The Essence Of America's Army

DCS PER Vision



Total Army

- *SIDPERS-3 -> DoD Integrated System*
- *Combined PERSCOMs*
- *Increased civilian leadership*
- *Major reliance on Reserve Components*

Quality Soldiers: The Essence Of America's Army

DCS PER Vision



Human Resource Systems

- *Pay and personnel functional integration*
- *Integrated DoD personnel information system*
- *Common personnel acquisition system
recruiting*
- **KISS**

Quality Soldiers: The Essence Of America's Army

DCS PER Vision



Ensures Readiness

- *Modularity and Tailorability*
- *Challenge the efficacy of current
organizations*
- *Split Based-requires dispersed teamwork*
- *Civilians on the battlefield*

Quality Soldiers: The Essence Of America's Army

DCS PER Vision



Supports Army Values

- *A human resource responsibility*
- *Ensure human resource system maximizes human potential*



Quality Soldiers: The Essence Of America's Army

What The Army Can Expect in AAN



- High OPTEMPO and PERSTEMPO
- Flat budget (declining in value)
- Information & technology explosion
- Expanding demand for non-traditional missions
- Increased outsourcing & privatization
- Trend to lighter and more mobile forces
- Evaluation of forward deployment concept
- Maintain high level of readiness



Quality Soldiers: The Essence Of America's Army

HR Implications of the AAN



The Military's Influence on Society

- Smaller therefore less influential
- Fewer Congressmen with military service
- Fewer families with family connection to the military
- Fewer military facilities (700 BRAC domestic closures)

A Continued Decline in Propensity to Enlist

- Youth Attitude Tracking Study (YATS)
- Competing with businesses that offer college as incentive
- Propensity low, but still enlist = attrition challenge

Tomorrow's HS Graduate may not have the "right stuff"

- Cognitive ability; moral and ethical training; social adjustment
- Motivation potential; psychological stability

Quality Soldiers: The Essence Of America's Army

HR Implications of the AAN



Diversity

- Demographics a reflection of society?
- Impact on Civilian-Military relations
- Minority population redefined

Required Soldier attributes will become more defined

- Leaders operating with more autonomy
- Higher leader to led ratio
- Artificial Intelligence and remotely piloted systems

Types of Soldiers we require will change

- Specialization
- NCOs as systems managers and integrators
- Compensation must compete with civilian demand for same skills

Pay for Performance/Pay for Value

- Target specialties and grades to shape the force
- Retirement system

Quality Soldiers: The Essence Of America's Army

Current Initiatives

Army Research Institute



- Assessing skills required by NCOs for successful performance in 21st century
- Developing battle command skills for the digitized environment
- Use of simulations for training future battlefield scenarios
- Virtual reality training for individual combatants
- Effects of stabilizing commanders' assignments on unit performance
- Lessons learned from SF personnel performance and training

Quality Soldiers: The Essence Of America's Army

Current Initiatives

RAND Arroyo Center



- Assessing PERSTEMPO
- Managing turbulence
- Alternative staffing to counter reduced manning levels
- Marketing alternatives in recruiting
- Reevaluating personnel and family support programs
- Designing new systems to simulate and test CSS C2

Quality Soldiers: The Essence Of America's Army

Current Initiatives



CSA Key Issues Involving DCSPER

Leadership Environment and Human Dimension of Change.

“How do we ensure that there is confidence within and without the Army, that reinforces the qualities that make us a valued-based institution?”



Operational Readiness/Force Structure Management.

“Given current and projected external demands and missions, how does the Department balance force structure, end strength, and recruiting/retention in order to maintain a trained and ready force capable of sustained combat operations?”



Quality Soldiers: The Essence Of America's Army

Scratching the Surface...



Evaluation System -- one or many given a changing environment

Rank Structure -- NCO or Specialist?

Turbulence impact in a high technology environment?

How do we train soldiers to keep up with changing technology?

-- Fire/Hire/Retain OR Hire/Train/Retain/Retrain?

Implications of some units arriving at a higher technological status before others.

Augmentation of sensory and perceptual capabilities.

Human factors engineering.

Quality Soldiers: The Essence Of America's Army

Conclusion



The Army's people will remain its most critical resource.

We are at a critical crossroads.

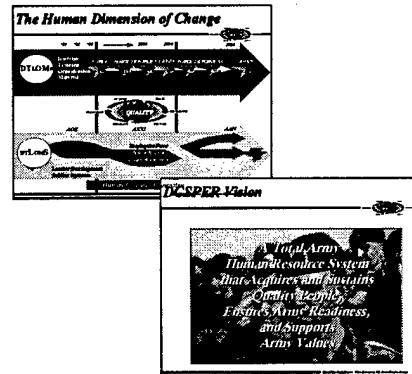
We must embrace an innovative approach.

Change or Die.

Quality Soldiers: The Essence Of America's Army



What we need:



Your learned thought.

Quality Soldiers: The Essence Of America's Army

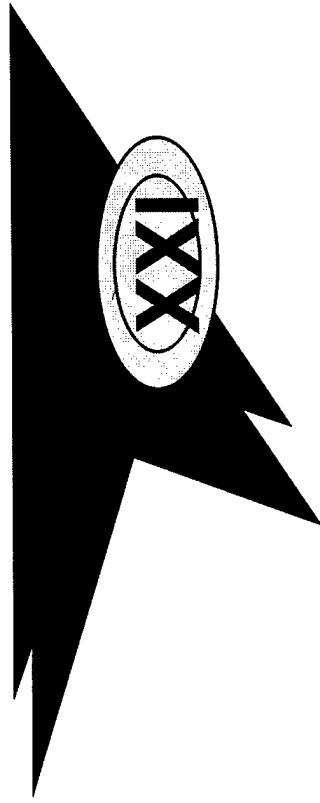
AAN Conference -- 13 Nov 97

OPMS Task Force

xxi

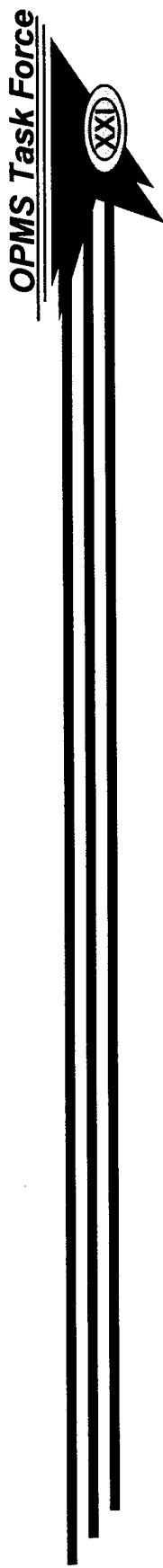
Developing an Officer Corps to Lead

OPMS



...Leaders for the 21st Century Army

the Total Army into the 21st Century

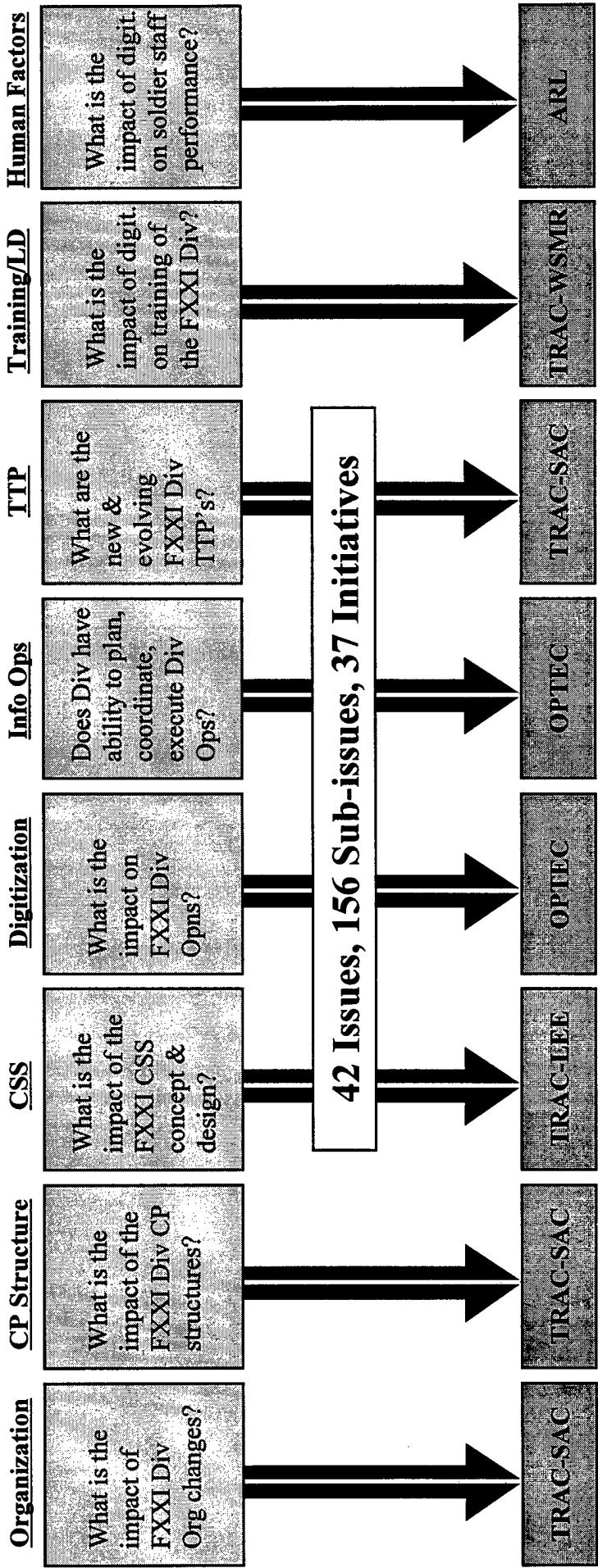


“Make Reality Match Rhetoric”

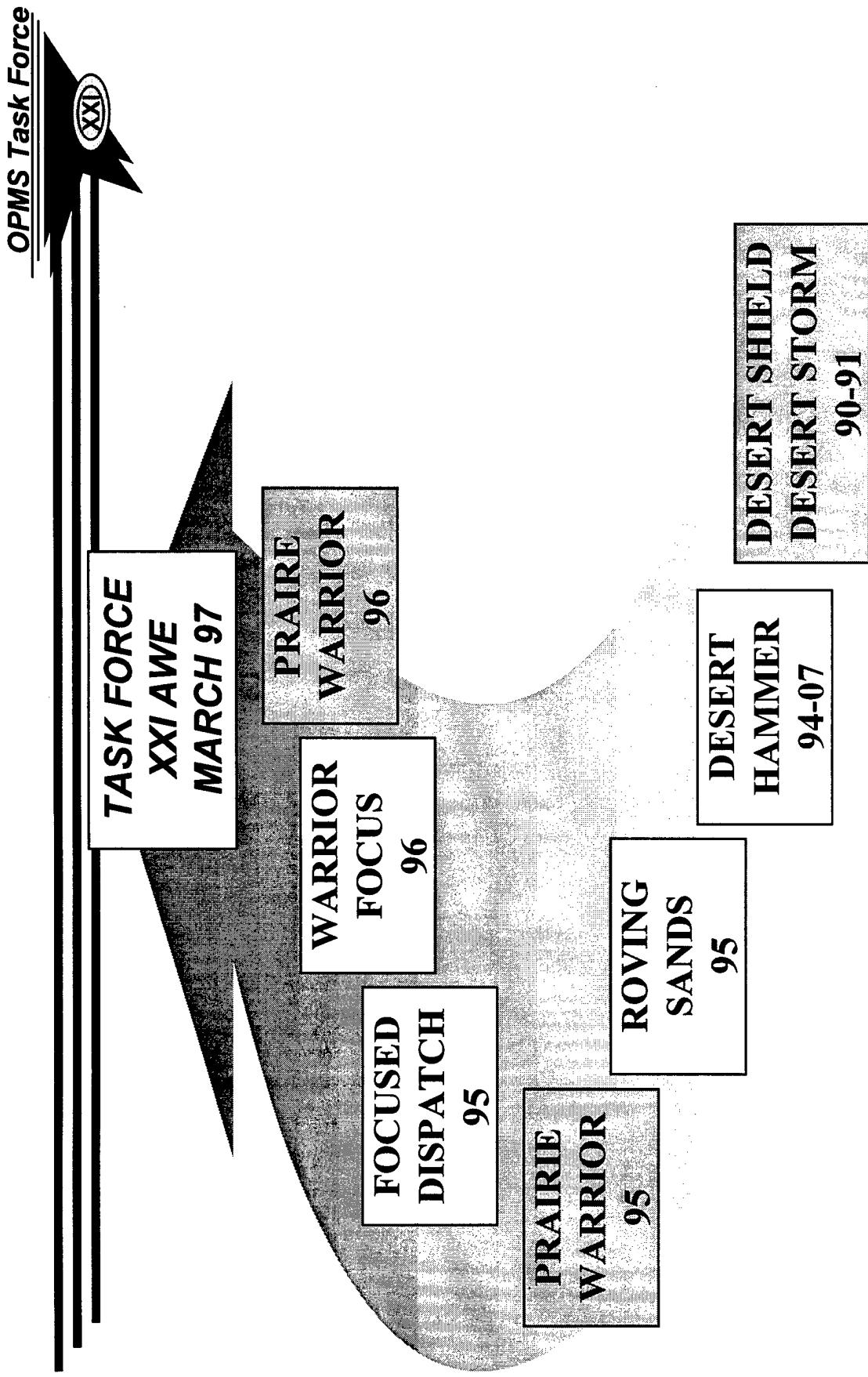
Dr. Cathy Downes
New Zealand Defense Force

DAWE XXI

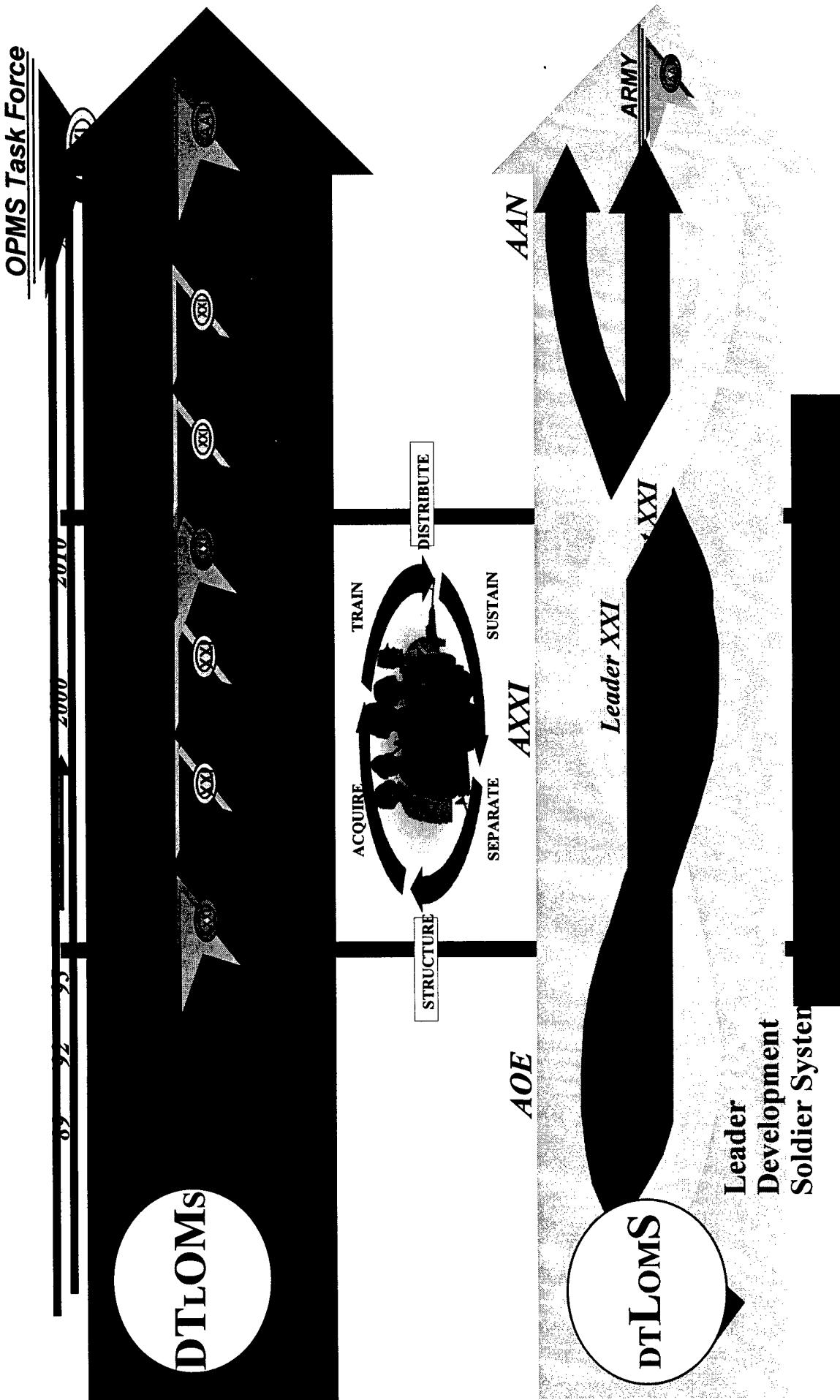
Hypothesis: If the Force XXI divisional, operational and organizational concept enables information dominance and enhance emerging battle command capabilities, then increases in lethality, survivability, sustainability, and tempo will be gained across the force.



Where We Were



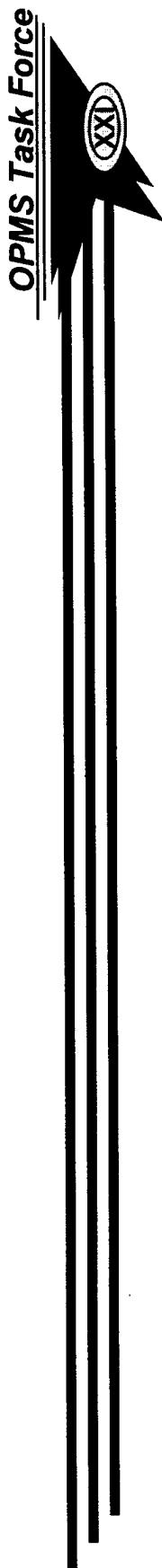
The Human Dimension of Change



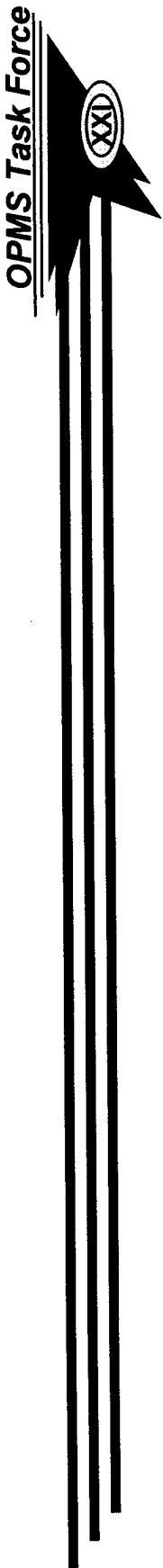
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Leaders for the 21st Century Army 5

Architecture of OPMS XXI Study

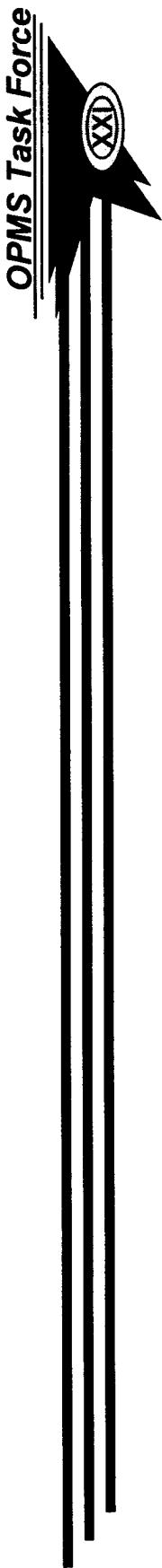


What's Right Today?



- ✓ *Warfighting is Job #1*
- ✓ *Core values are important to the Officer Corps*
- ✓ *Proven systems for producing competent and caring leaders*
- ✓ *Centralized board system process gives us what we ask for*

What We Could Do Better Today



- ***The affordable inventory of officers neither aligns with nor meets force structure requirements***
- ***OPMS, OER, and Leader Development Model are not aligned...both Army and officers suffer***
- ***Assignment turbulence does not promote cohesive and effective teams...either in the TOE or TDA***
- ***OPMS lacks formal mechanism to anticipate or adapt to change***

Why Some Things Right Today Could Be Wrong Tomorrow...••OPMS Task Force

Some Important Emerging Trends

Some Potential Effects on OPMS XXI

- *Force structure reductions & changes*
- *Eliminate/consolidate/create branches*
- *Different/shorter/tailored/more frequent MEL/CEL blocks*
- *Blending of TDA & TOE*
- *Career model changes*
- *Different assignment patterns*
- *Increasing need for multi-functionality*
- *Requirement for an integrated officer development system*

XXI

ODS Characteristics

OPMS Task Force

*Better for the
XXI
Nation*

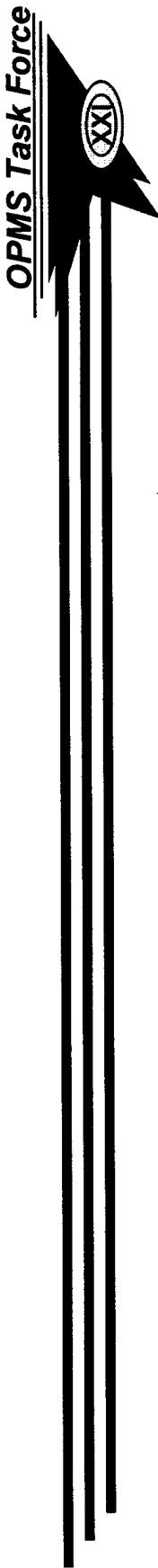
- ★ *Develop motivated, competent and experienced officers within and across all functions (2)*
- ★ *Integrates the leader development system and the OPMS*
- ★ *Fosters sustained unit excellence (3)*
- ★ *Matches operating inventory to authorizations*
- ★ *Promotes AC and RC interoperability*
- ★ *Develops Army officers who perform effectively in a joint environment*
- ★ *Develops Army officers who personify enduring Army values (1)*

*Better for the
Officer*

* Characteristics highlighted in black were weighted most important by Council of Colonels

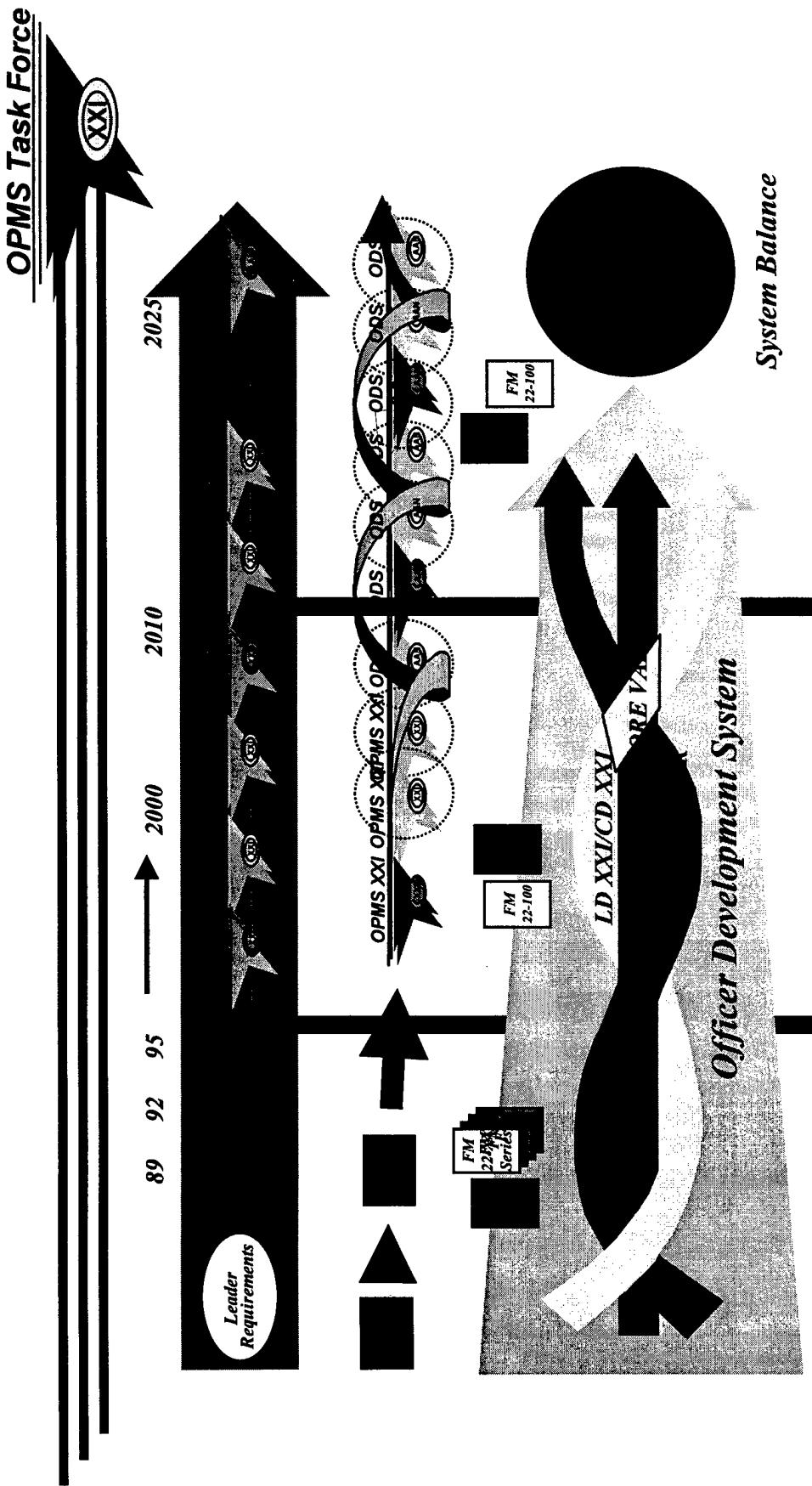
...Leaders for the 21st Century Army

Design Criteria



- **Enhance warfighting capability of the Army**
 - Increase MAJ “BQ” time
 - Reduce turbulence for Operational Career Field
- **Provide all officers with a reasonable opportunity for success**
 - Increase promotion opportunity
 - Increase command opportunity
- **Balance grades and skills at the Field Grade level**
 - Reduce upward grade substitution
 - Increase level of fill
 - Improve COL level experience

What Kind of Leader Do We Need?



Leadership Shaping Factors

```

graph TD
    LSF[Leadership Shaping Factors] --> Cog[Cognitive]
    LSF --> Emo[Emotional]
    LSF --> Situ[Situational]
    Cog --> I[Improvization]
    Cog --> ME[Multifunctional Expertise]
    Cog --> PI[Pattern Interpretation]
    Cog --> SS[Systems Synthesis]
    Cog --> ML[Modular Leadership]
    Emo --> DD[Deliberate Decisions]
    Emo --> C[Centralization]
    Emo --> PE[Physical Experience]
    Emo --> SR[Separation of Roles]
    Emo --> O[Orchestrational]
    Situ --> SO[Sequential Opna]
    Situ --> L[Linearity]
    Situ --> H[Hierarchical]
    Situ --> NLA[Non-Linear Analysis]
    Situ --> FL[Fuzzy Logic]
    Situ --> VV[Virtual Warfare]
    Situ --> UTMO[Unified Theory of Military Ops]
    Situ --> FOST[fusion of Strategy/Ops/Tactics]
    Situ --> AI[Artificial Intelligence]
    Situ --> DMP[Decision-making Prosthetics]
    Situ --> R[Robotization]
  
```

- **Abbreviated Decision-Making**
- **Creative & Intuitive Thought**
- **Virtual Experience**
- **Blending of Roles/Interoperability**
- **Info Warfare**
- **Unified Theory of Military Ops**
- **Fusion of Strategy/Ops/Tactics**
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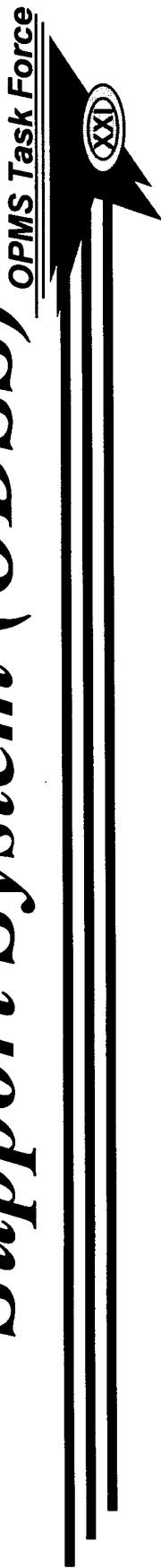
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- **Blending of Rules/Interoperability**
- **Info Warfare**

System Balance

AN/12-Nov-97

...Leaders for the 21st Century Army

The Officer Development Support System (ODSS)



- **Task:** Establish an Officer Development Support System (ODSS)
- **Purpose:** Ensure the ODS:



- Sets the stage for an Army Development Support System (ADSS)

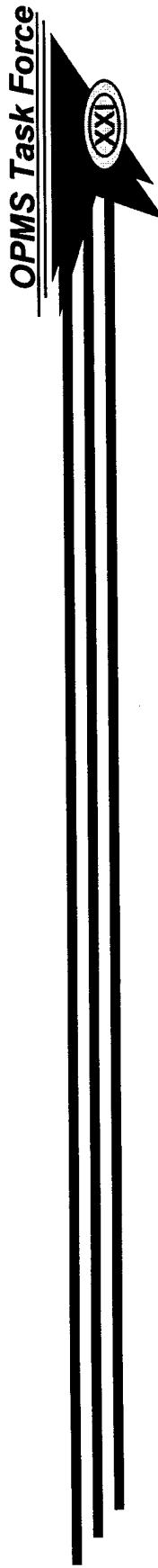
ODSS: Annual Review Process



Officer Development Updates (ODUs)

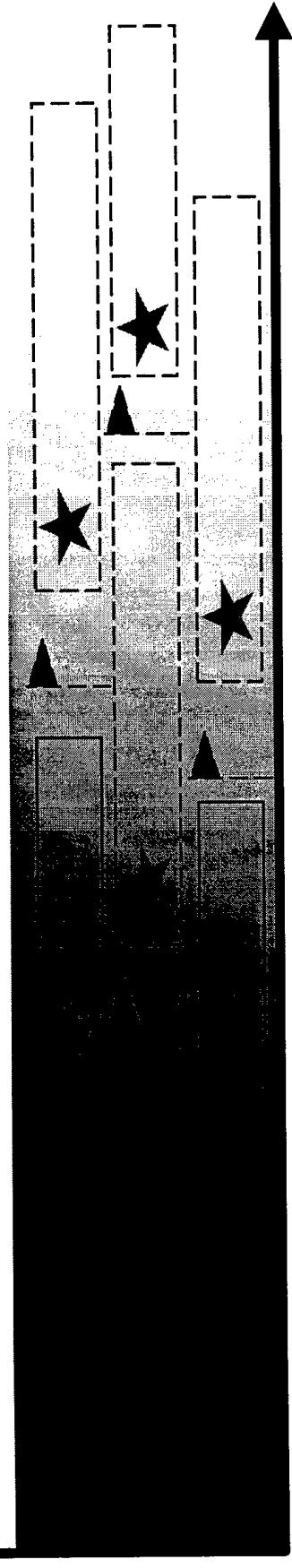
- Annual review of the entire system
- Tied to Operating Strength Review process and other initiatives
- Provides CSA holistic review process for all aspects of ODS
- Adaptable to an Army Development System

ODSS: Action Plans

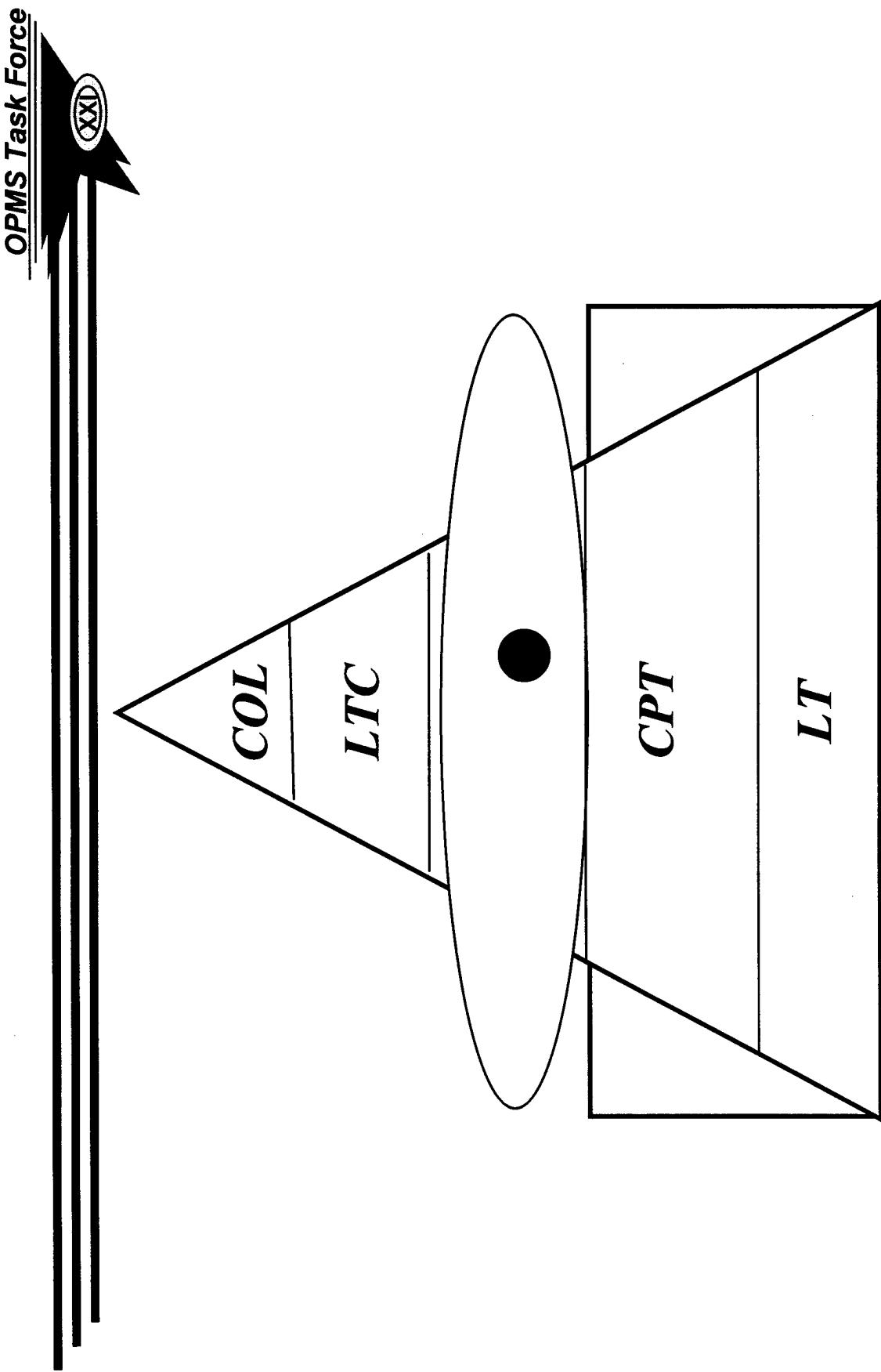


Officer Development Action Plans (ODAPs)

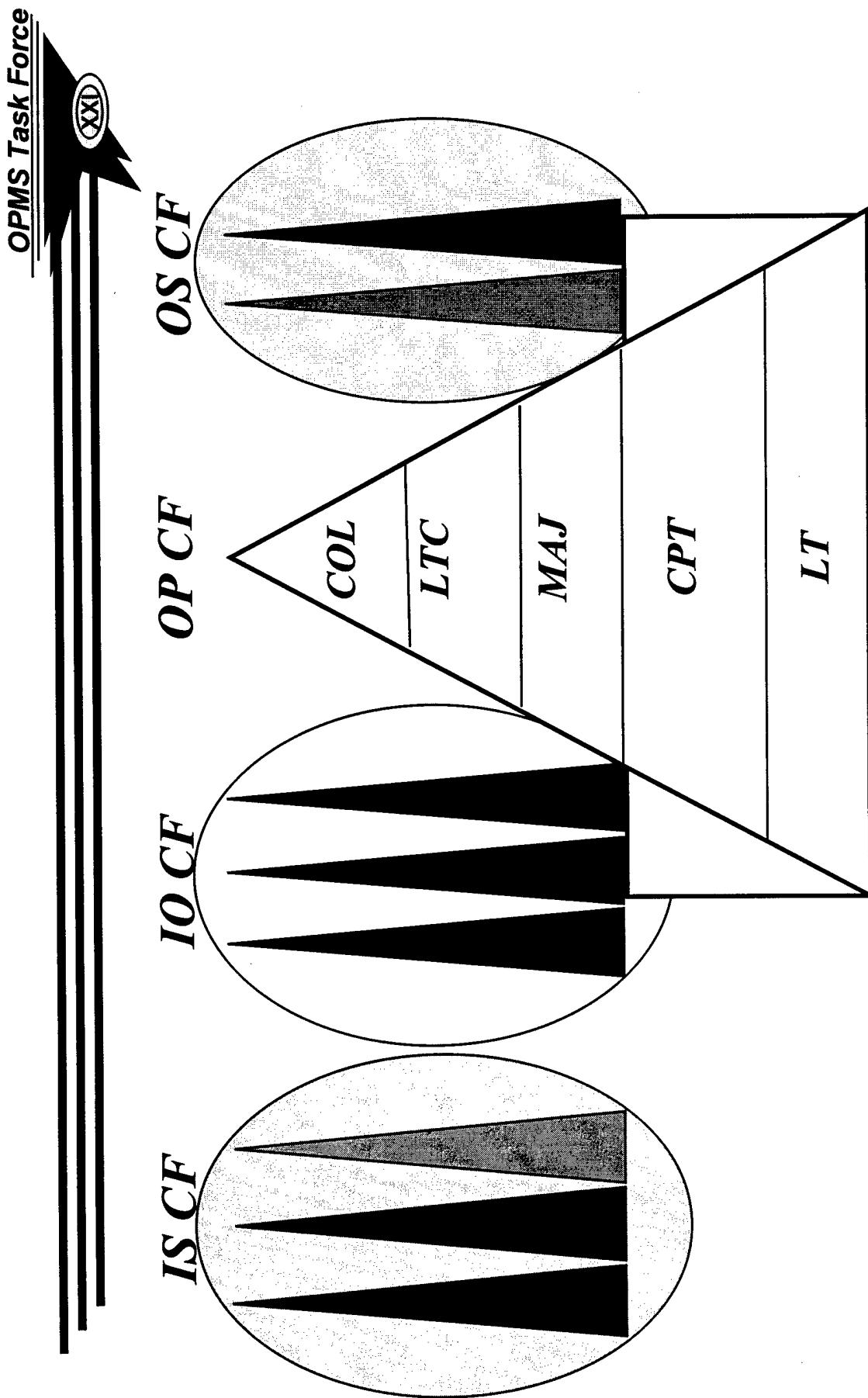
- One Per Career Field
- Supporting initiatives (ODI's) apply to one or more life cycle functions
- Address today's issues; anticipate tomorrow's



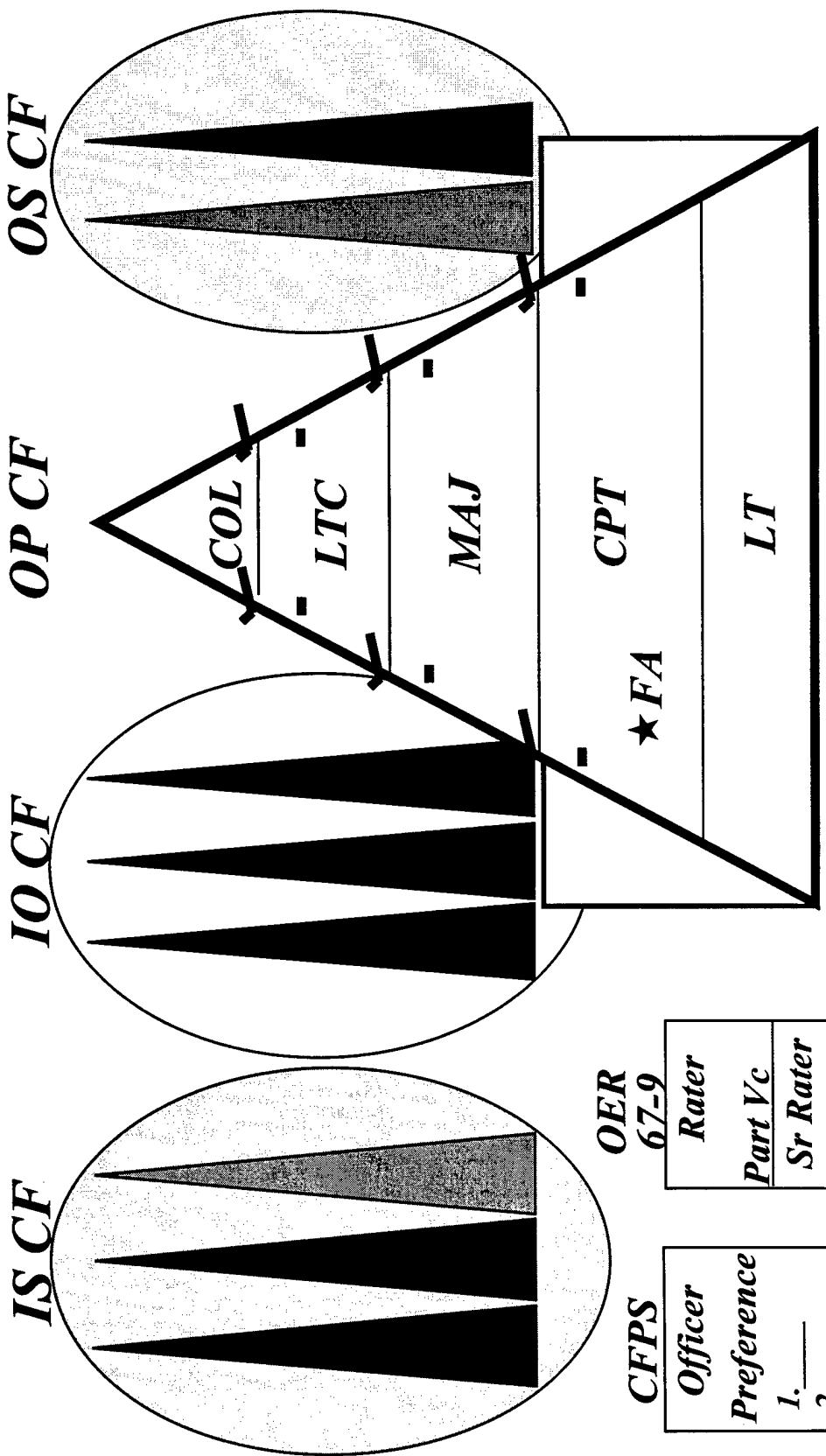
Majors - the Problem



Career Fields

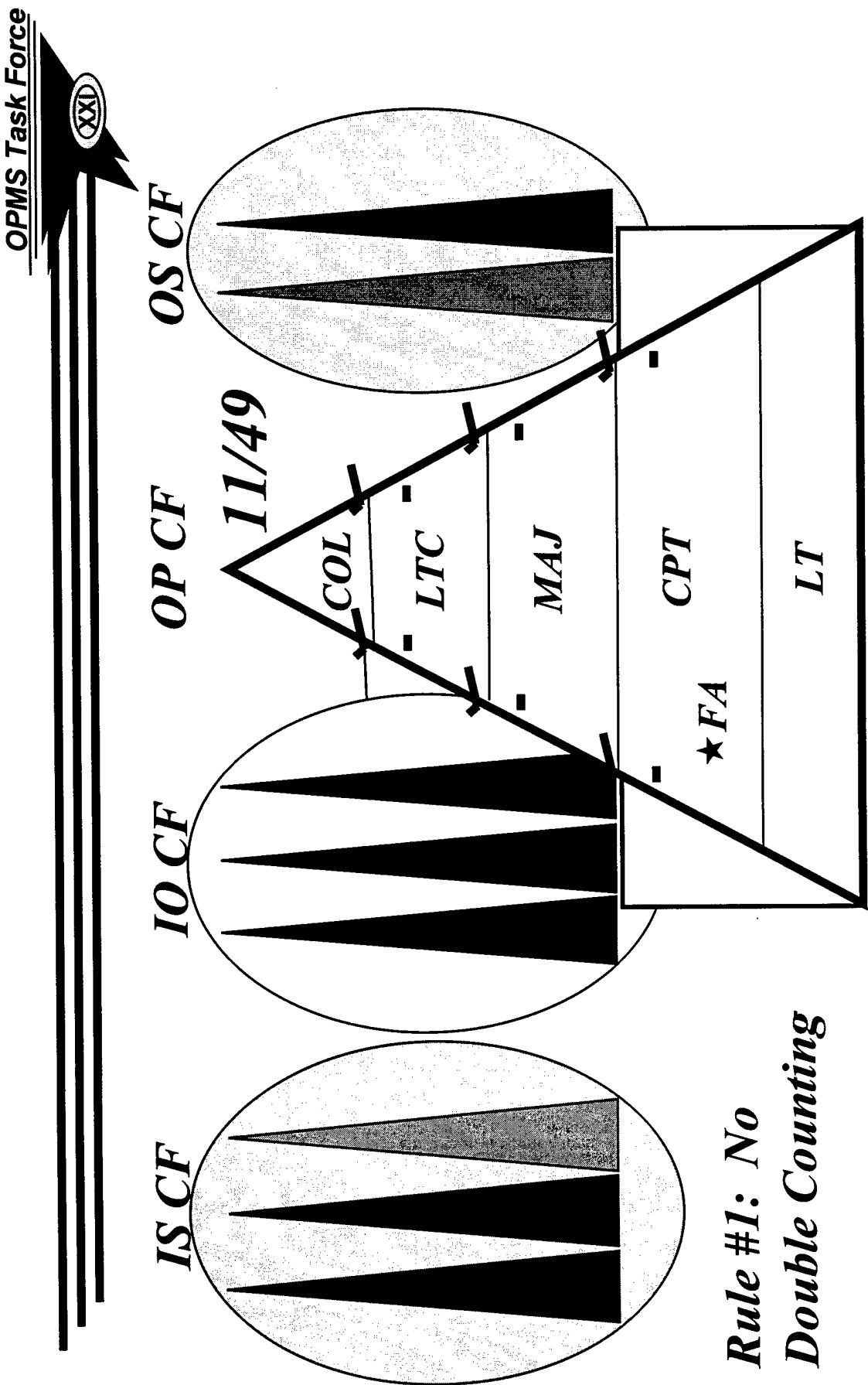


Career Field - Choices



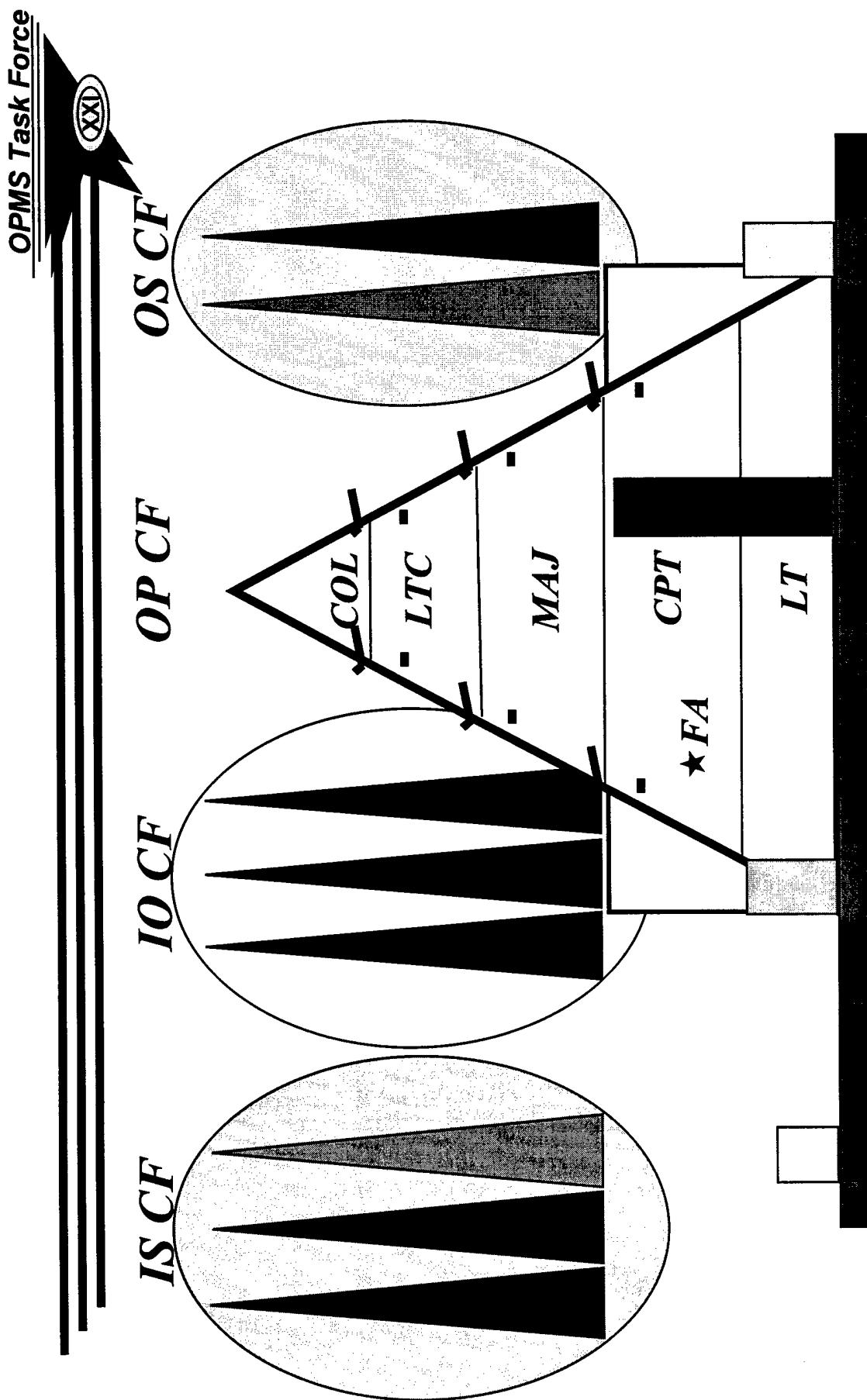
...Leaders for the 21st Century Army

Career Fields - Counting

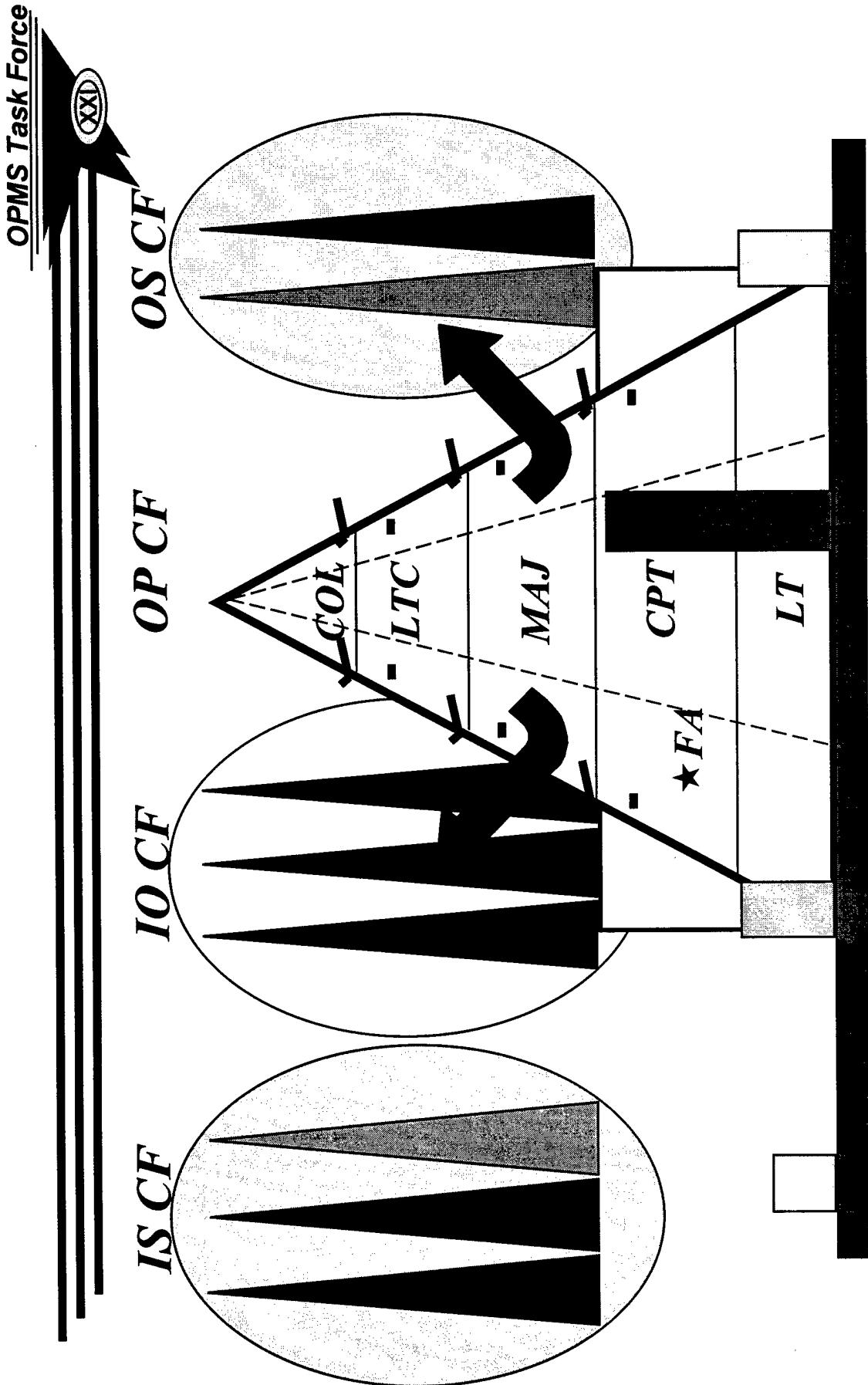


**Rule #1: No
Double Counting**

Career Field - Promotions



Career Field - Endstate in AAN



Information Operations Career Field



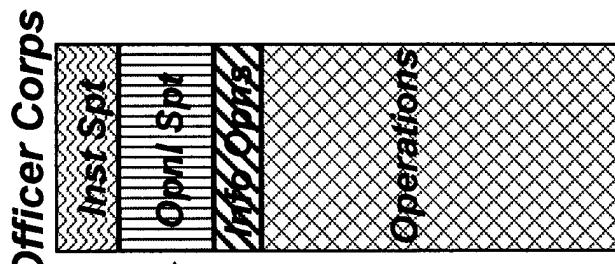
Responds to requirements of 21st Century Information Age

Information Operations Functional Areas

- FA 30: *Information Operations*--Includes the systems, intel, & opns integration functions
- FA 34: *Strategic Intelligence*--Encompasses 35 billets not in the Operational force
- FA 40: *Space Operations*--Focuses on exploiting the capabilities of space based systems
- FA 46: *Public Affairs*--Remains as currently configured
- FA 53 (A,B,D): *Automation Systems*--Remains as currently configured
- FA 57: *Simulations Operations*--Includes all aspects of electronic simulations & exercises

Operational Support

Career Field



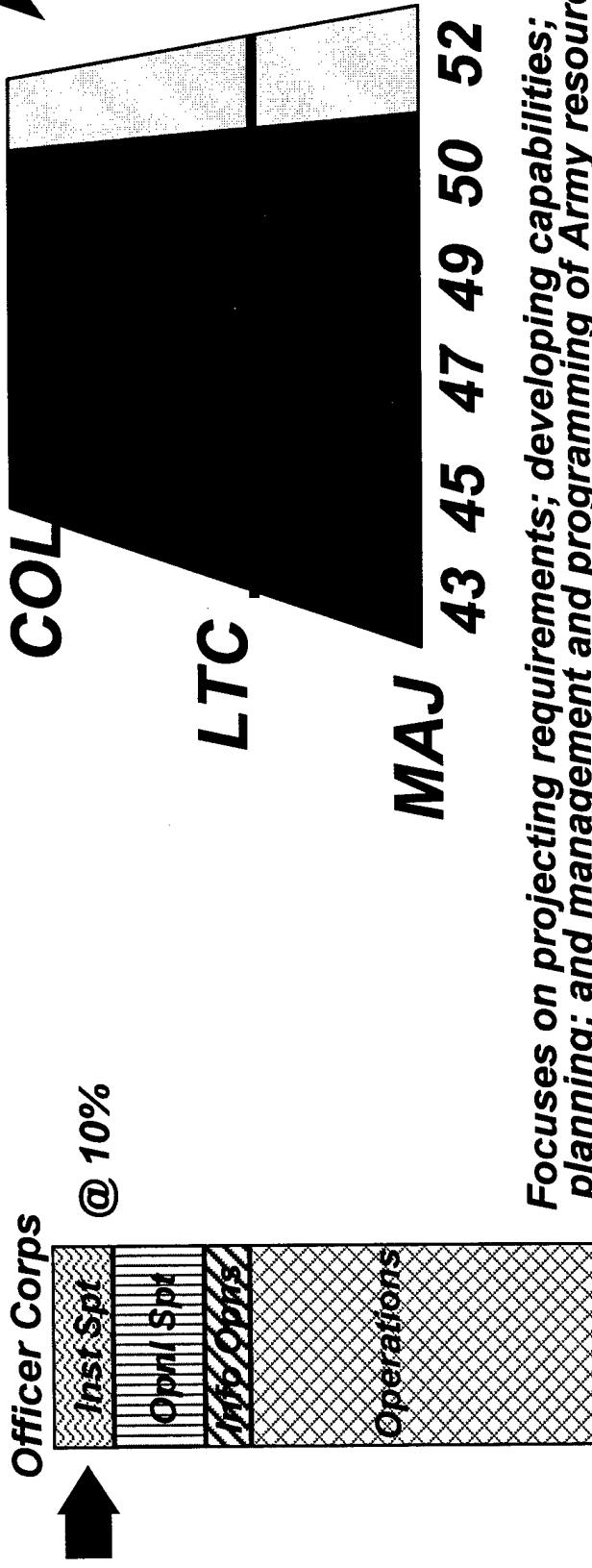
Focuses on liaison, development and procurement functions

Operational Support Functional Areas

- **FAs 51, 53B/C, and 97: Army Acquisition Corps(AAC) -- Remains as currently configured**
- **FA 48: Foreign Area Officer--Remains as currently configured**

Institutional Support Career Field

OPMS Task Force
XXI

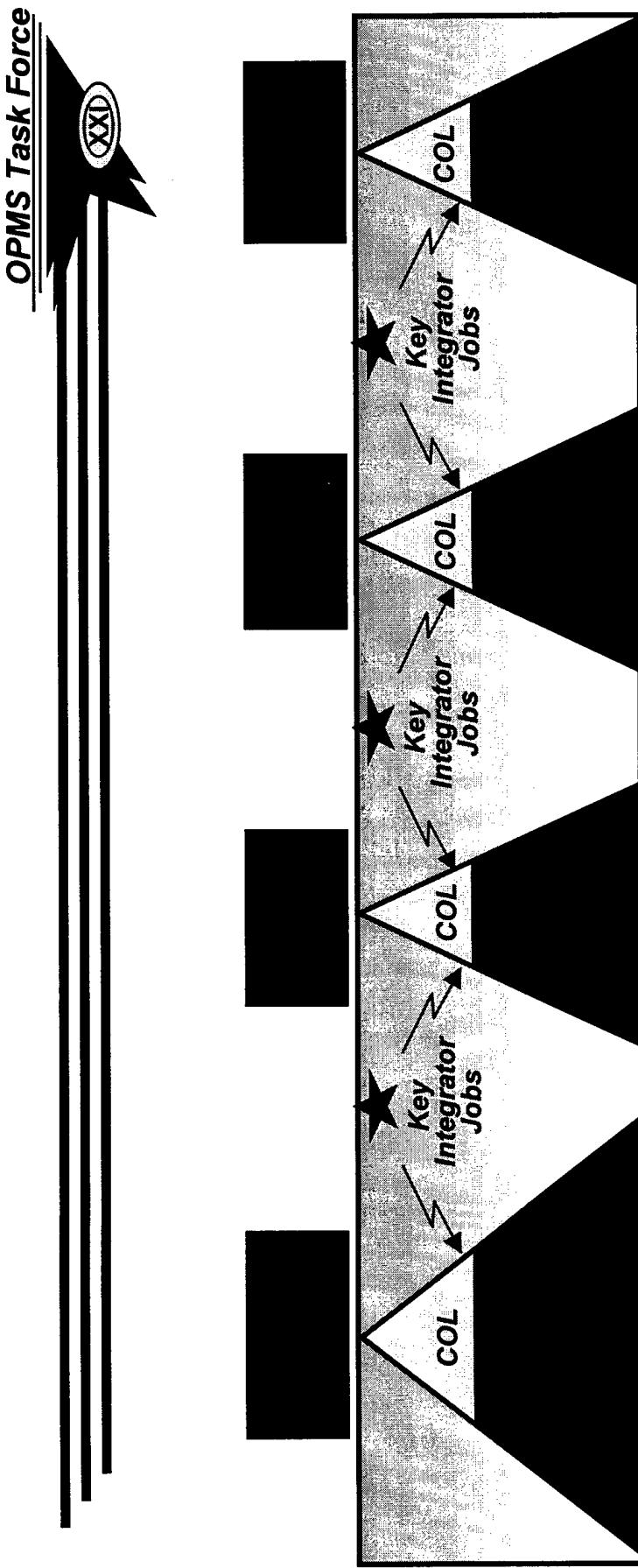


Focuses on projecting requirements; developing capabilities; planning; and management and programming of Army resources

Institutional Support Functional Areas

- **FA 43: Human Resource Managers**--Specialists in designing and implementing Human Resource Management Systems
- **FA 45: Comptroller**--Remains as currently configured
- **FA 47: USMA PAP**--Remains as currently configured
- **FA 49: Operations Research & System Analysis**--Remains as currently configured
- **FA 50: Strategy and Force Development**--Resurrect this FA and infuse with Force, Combat, Training, and Doctrine Developers
- **FA 52: Nuclear Weapons**--Remains as currently configured

Functional Integrator Positions



Functional Integrator Positions

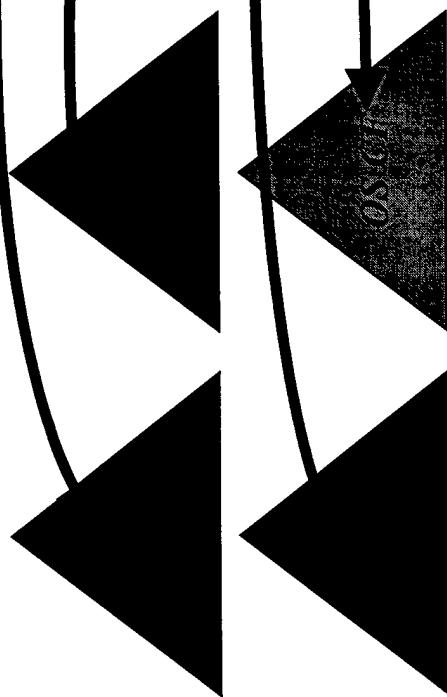
- Duty positions which are *not tied to a specific Career Field*
- *Most positions are in the areas of Training, Education, and Staff*
- Examples: AC/RC positions, CAS3/CGSC/War College instructors, some Army Staff positions, MACOM Hq positions
- *Functional Integrator Positions give the Army officer assignment flexibility*

Career Fields Integrated into Organizations

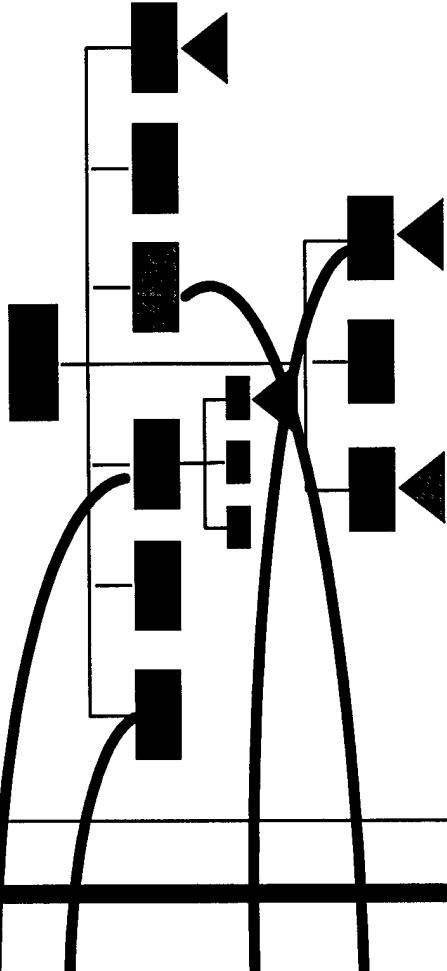
OPMS Task Force

(xx)

Personnel Management Categories



Organizational Assignments



Career Fields

Units/Organizations

Career Fields ≠ Organizational Assignments

- Career fields are a personnel management tool to ensure the Army develops and assigns officers in accordance with its needs
- Officers from all career fields could be assigned to the same Army organization -- and in many cases should be
- Assignments by both BR and "Functional Integrator (FI)" or FA and FI jobs

OPMS XXI Recommendations: Develop New Army Systems

OPMS Task Force



• Develop Strategic Human Resource Management System

- Adopt a holistic and strategic approach to HRM
- Adopt and refine OPMS XXI TF family of models for SHR design
- Institute a HR update and review process

• Develop an Officer Development System (ODS) and an Army Development System (ADS)

- Integrate OPMS into ODS and develop an analogous Army Development System (ADS) for all army personnel
- Implement ODS NLT FY02
- Create an Officer Development Support System (ODSS) for ODS

• Develop CF-Based Management System

- Develop four CFs: Operations (OP), Operational Support (OS), Institutional Support (IS), Information Operations (IO)
- Implement CF designation process
- Examine relationship of OPMS XXI to Army's other personnel management systems
- Assess company grade development process
- Revise AR 600-3 and DA Pam 600-3 IAW OPMS XXI recommendations and decisions

OPMS XXI Recommendations: Develop Life Cycle Functions

OPMS Task Force

(xxi)

• Structure

- Establish DA level recoding mechanism for officer authorizations
- Establish DCSPER as 01A/02A proponent with CG PERSCOM as executive agent

• Distribution

- Transition from today's "dual track career management field" system to a "dual track assignment" system

• Acquire

- Change pre-accession civilian education requirements
- Develop a common approach to pre-accession military training, education and screening
- Reexamine how the Army accesses officers and make recommendations

• Develop

- Widen focus of leader development
- Increase emphasis on joint development
- Foster learning organizations throughout the Army
- Revise the officer education system

• Sustain

- Conduct CF-based promotion boards
- Reduce percentage of below the zone promotions
- Periodically reassess the new OER
- Implement categorized command selection by functional category

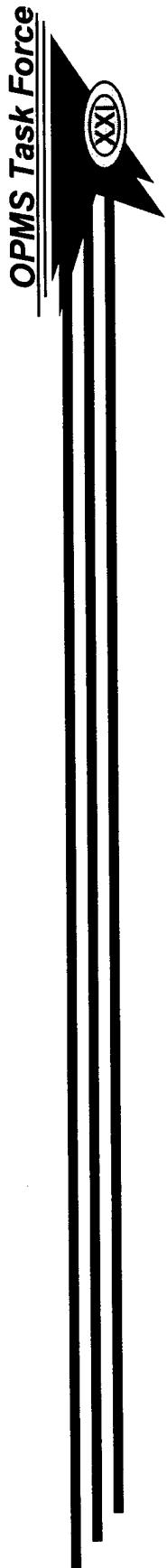
• Compensate

- Establish "compensation" as a separate life cycle function

• Separate

- Examine options for extending career lengths
- Examine feasibility of vesting officers at various years of service

Back Up Slides



ODS--A Strategic Human Resource System

OPMS Task Force

Need to Ask the Strategic Questions First;

Questions a strategic leader should ask

Strategic Questions:
How can the human resource management system be designed to enhance organizational performance?

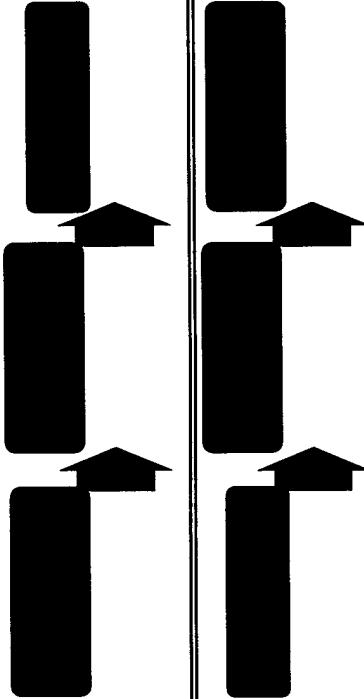
Questions a human resource expert should ask

Then Ask the Tactical Questions

Integrating Officer Development Holistically

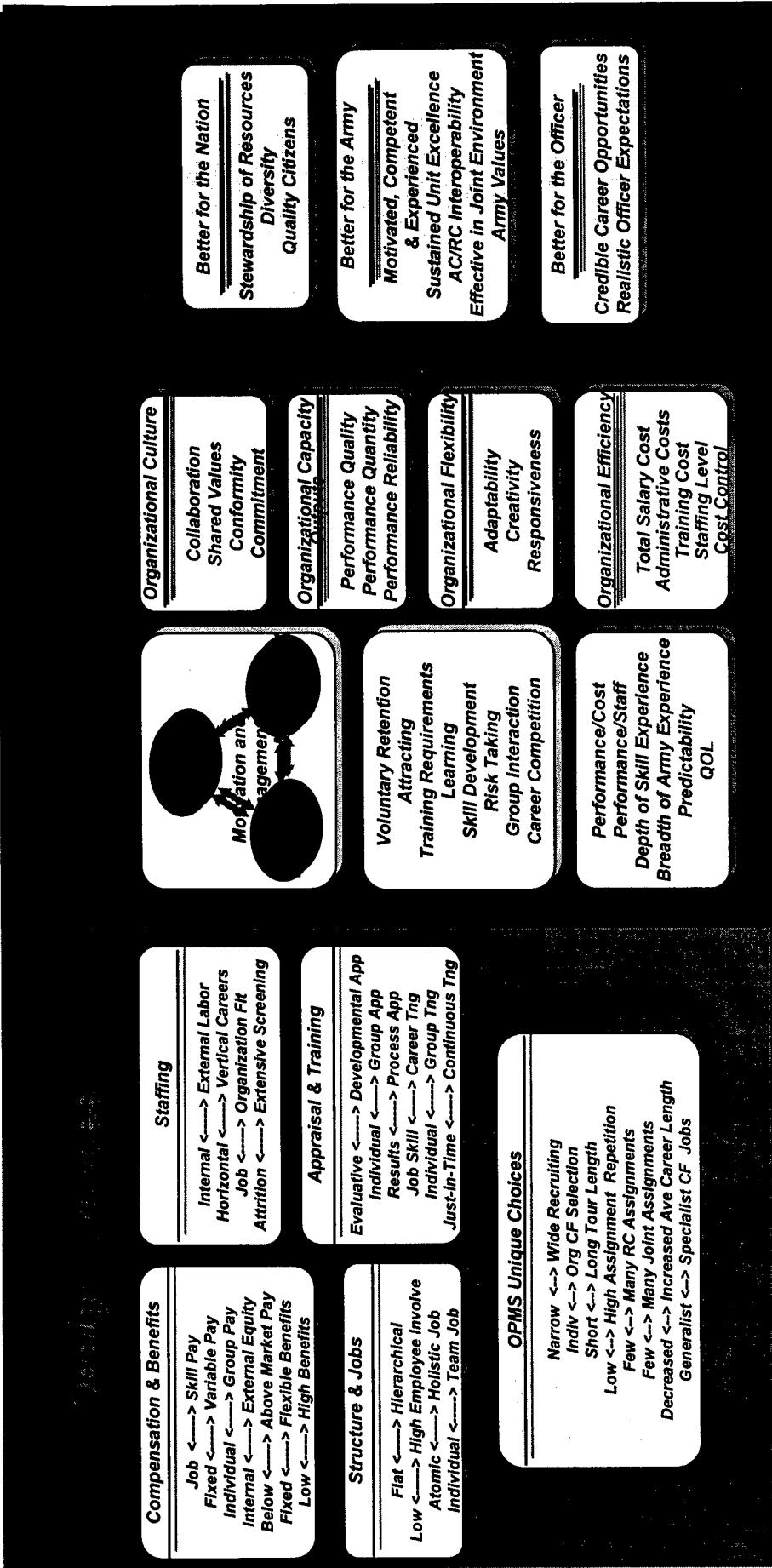
- Needed a methodology to tie the 12 ODS Characteristics to the alternative policies the Army could implement for each career field
- Employed a Strategic Human Resource Systems Model adapted from the 8th QRMCS work
- The HRSM Model provides a structured, systemic approach to developing and adapting OPMS for the future
- Options 2 & 2.5 accomplish strategic objectives consistent with the model
- Thus, Options 2 & 2.5 are not end states but adaptive interim systems that will evolve as the Army's needs and external environment changes

Relationships in the HRSM



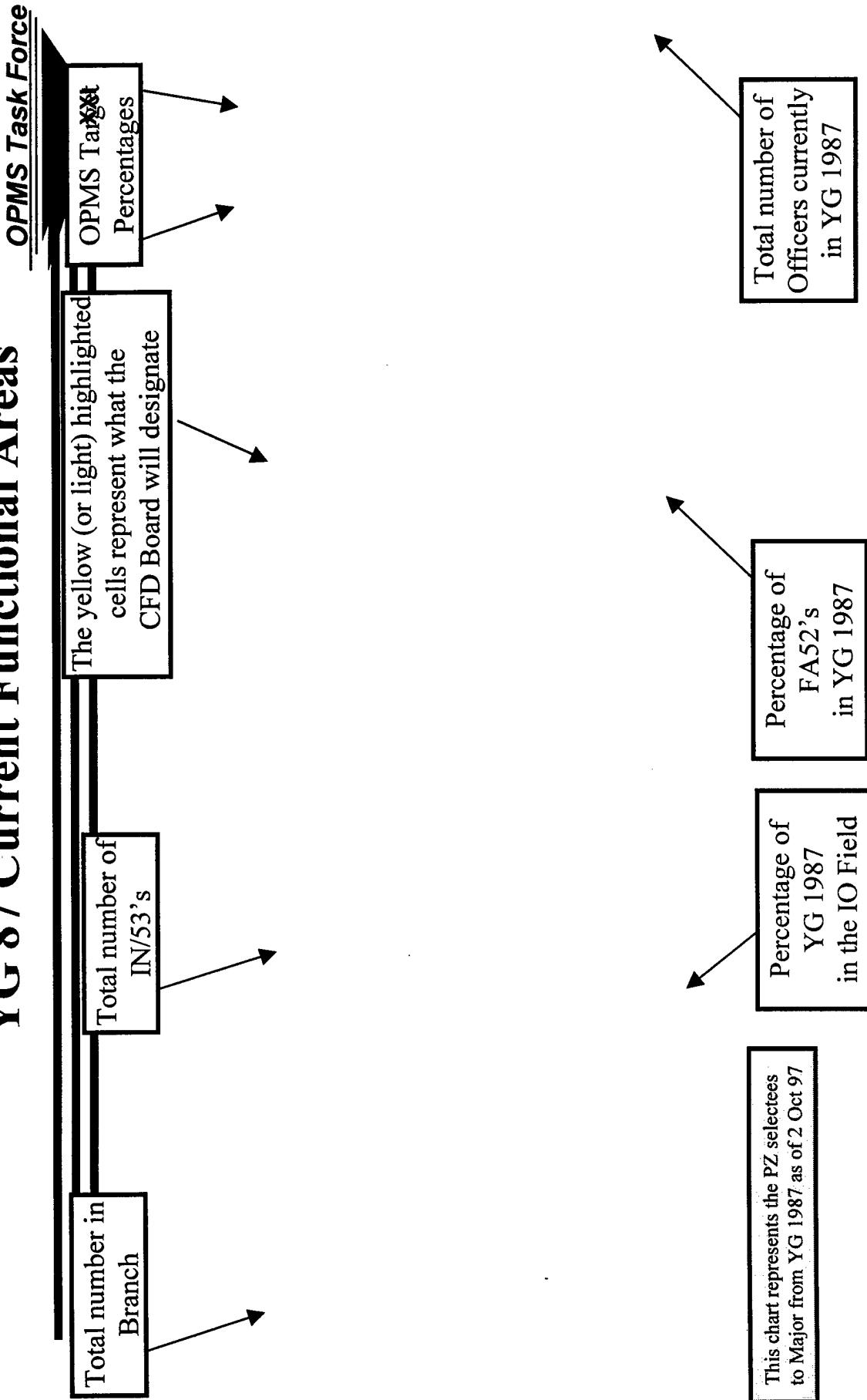
ODS as a Human Resource System

OPMS Task Force
XXI

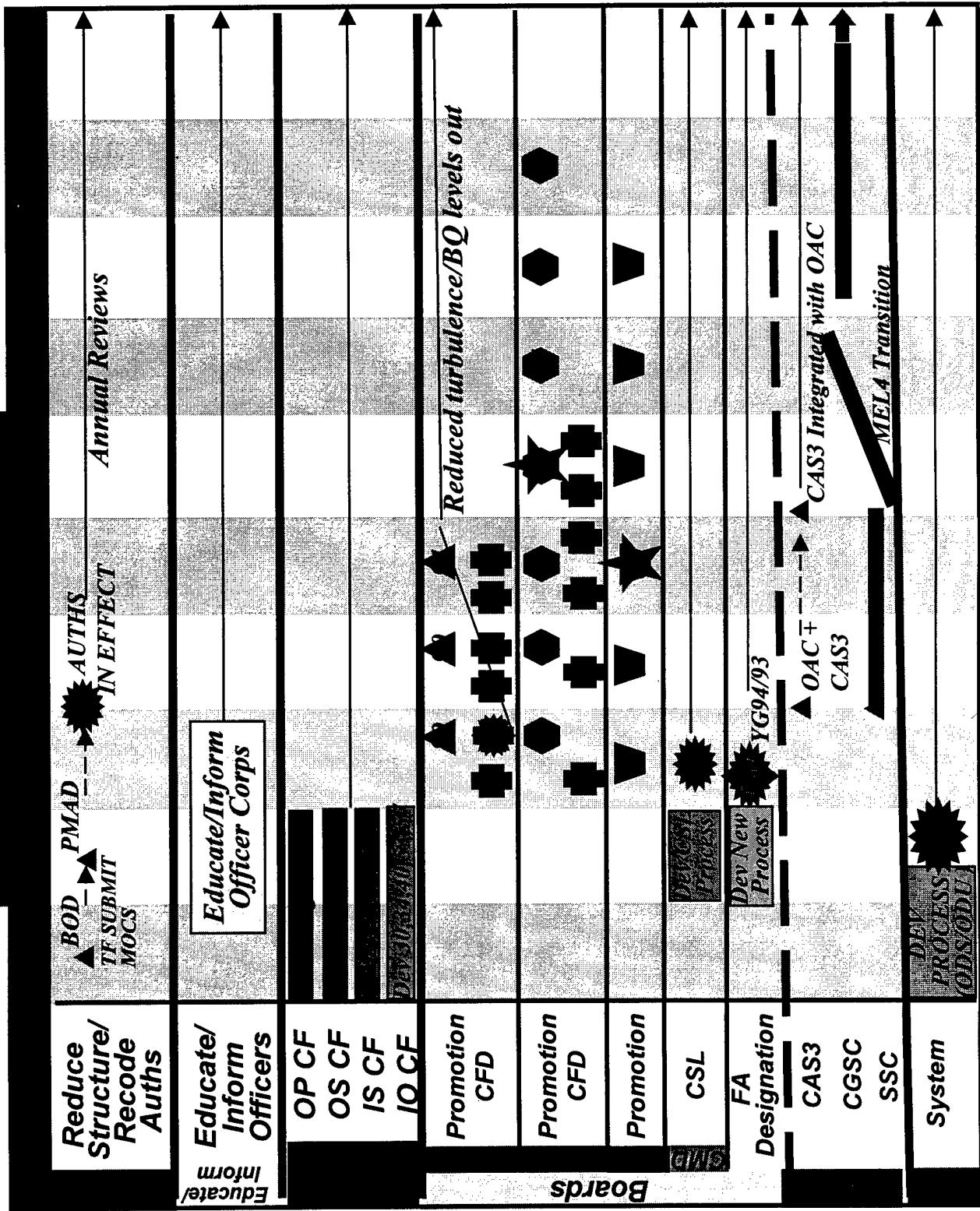


Career Field Designation

YG 87 Current Functional Areas

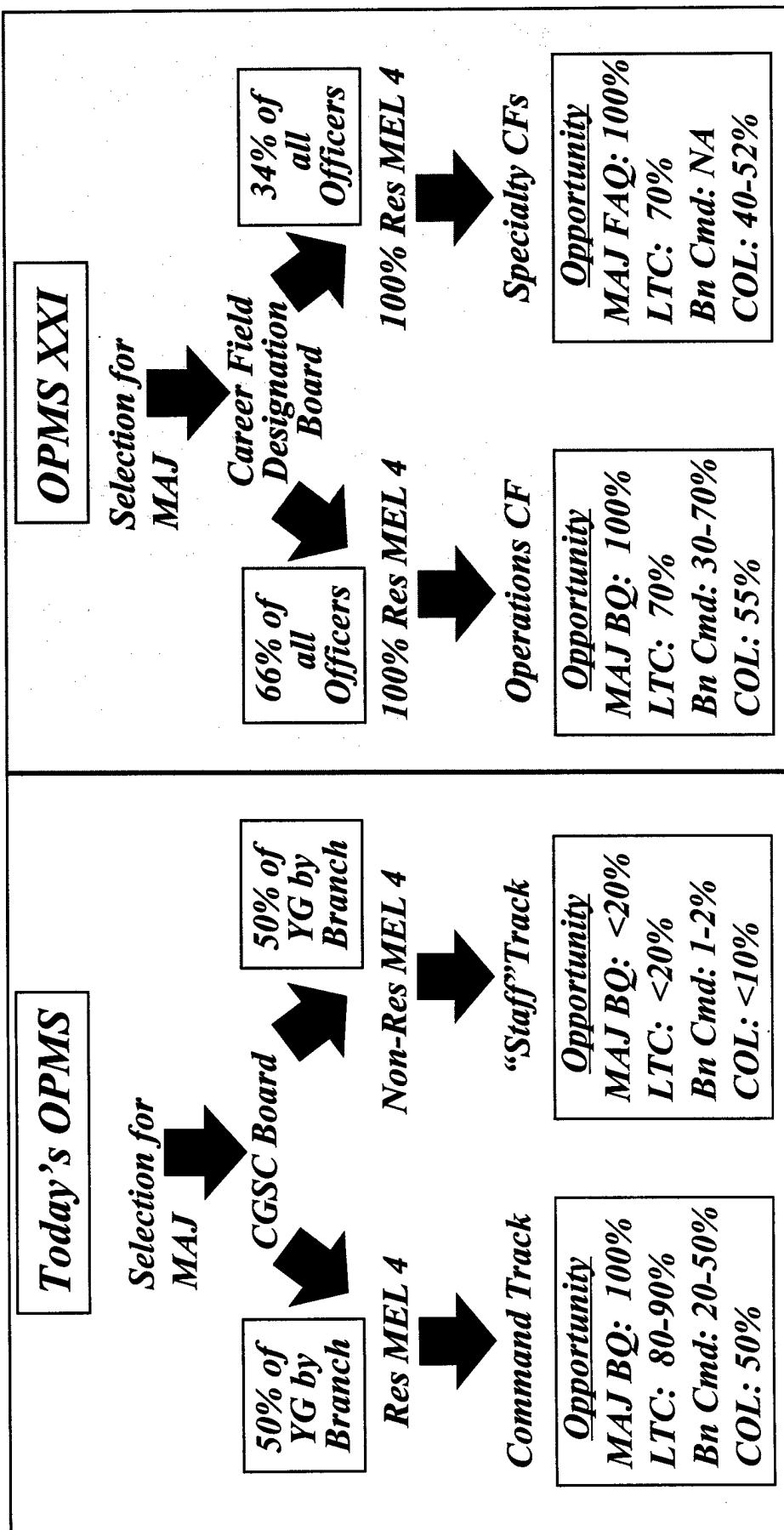


Implementation Plan

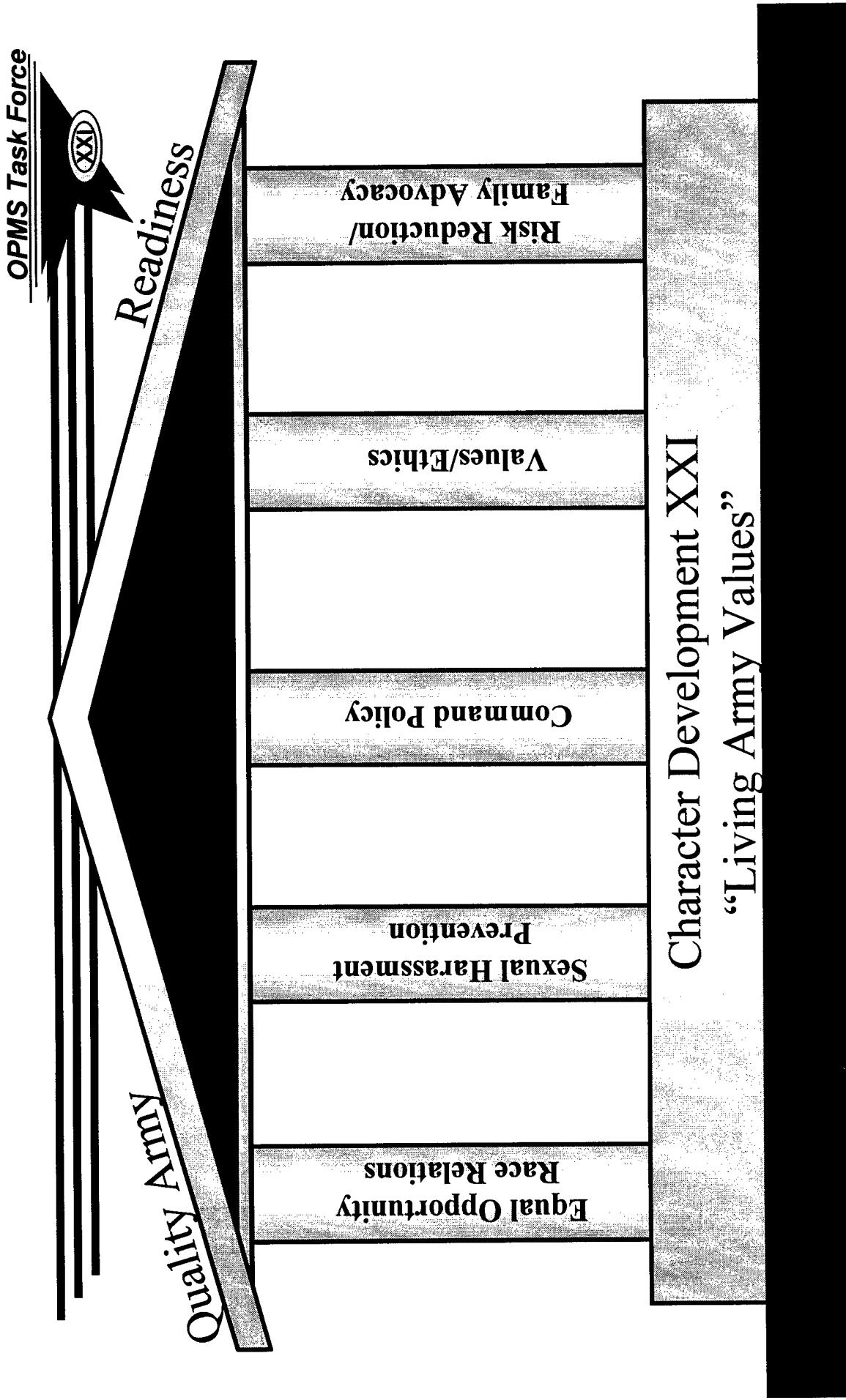


Keeping Hope Alive

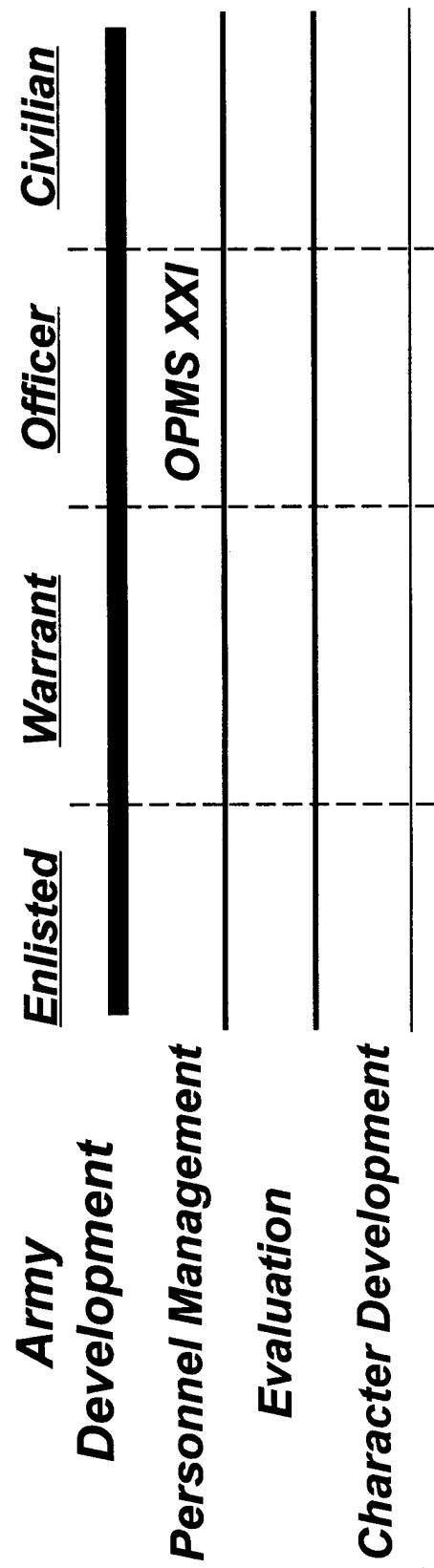
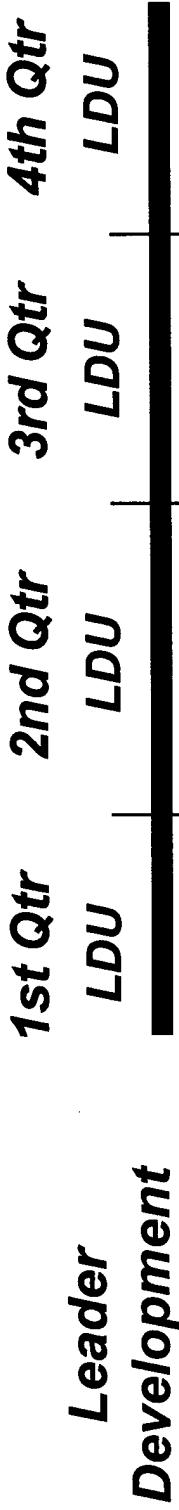
OPMS Task Force



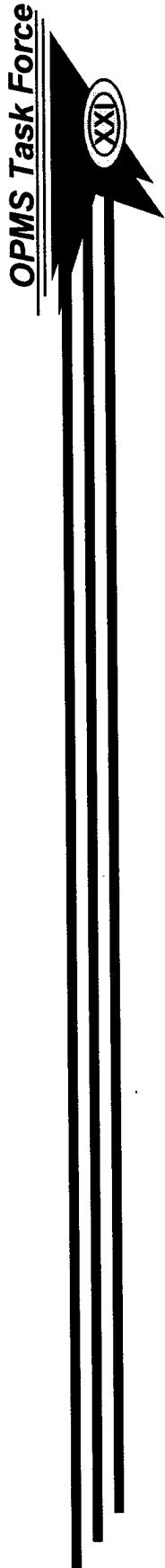
Character Development XXI: Re-establishing the force



Army Development System (Review Process)

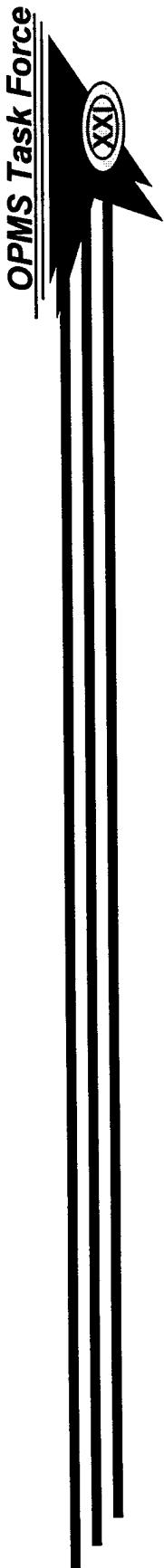


USAR and ARNG



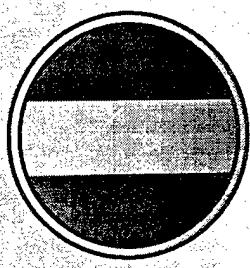
- Reserve components -- an integral and active part of OPMS XXI Task Force and current process
- OPMS XXI:
 - Tailors current forces for the future fight
 - Responds to current issues within officer corps
- Final plan includes recommendations that integrate active, guard and reserve components

OPMS XXI-Impact on Women



- *OPMS XXI is designed to be more equitable for all (including women and minorities)*
- *Provides alternate path to success in specialty career fields*
- *Emphasis on character development will result in reduced gender discrimination*
- *OPMS XXI provides forum for continuous assessment and review (gender issues may drive ODAP)*

THE ARMY AFTER NEXT PROJECT



KNOWLEDGE and SPEED

Emerging Impressions

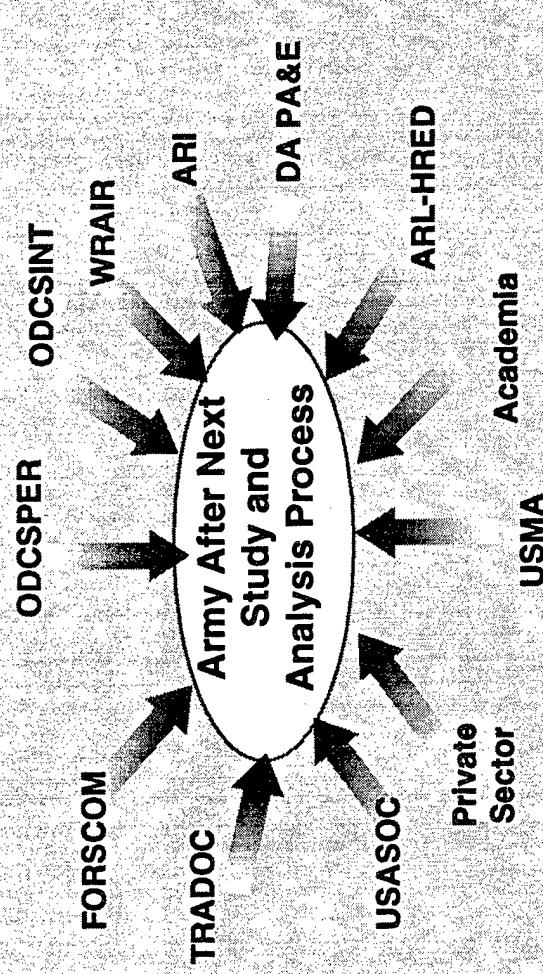
Deputy Chief of Staff for Doctrine
United States Army Training and Doctrine Command

Conference on 'Human and Organizational Issues in the Army After Next'



The Challenge

- Accommodate and harness technological, military art, and social change
- Change will effect recruiting, organization, training, and retention
- Many gaps exist in our understanding of soldiers, units, and the systems that support them
- Modeling and planning is ongoing



The AAN Project Needs Your Help

- Must better understand:
 - Soldiers, units, and their environment
 - Impact of ongoing and future change
- Must determine if military art concepts are feasible

This workshop will generate knowledge; AAN will integrate and build upon that knowledge



CSA GUIDANCE

Define what we want in the Army After Next so that ...

- **Force XXI expands to link Army XXI and Army After Next**
- **Force XXI does not get disjoined from long term vision**
- **Also, we must**
 - Focus our R&D efforts
 - Narrow the gap between heavy and light forces
 - Improve mobility, enhance firepower
 - Leverage the work already done in OSD's RMA studies
 - Identify organizational concepts that better integrate AC & RC
 - Revolutionize logistical concepts ... continue developing total asset visibility & velocity management
 - Institutionalize AAN concepts & process
 - Think joint and involve other services in AAN process

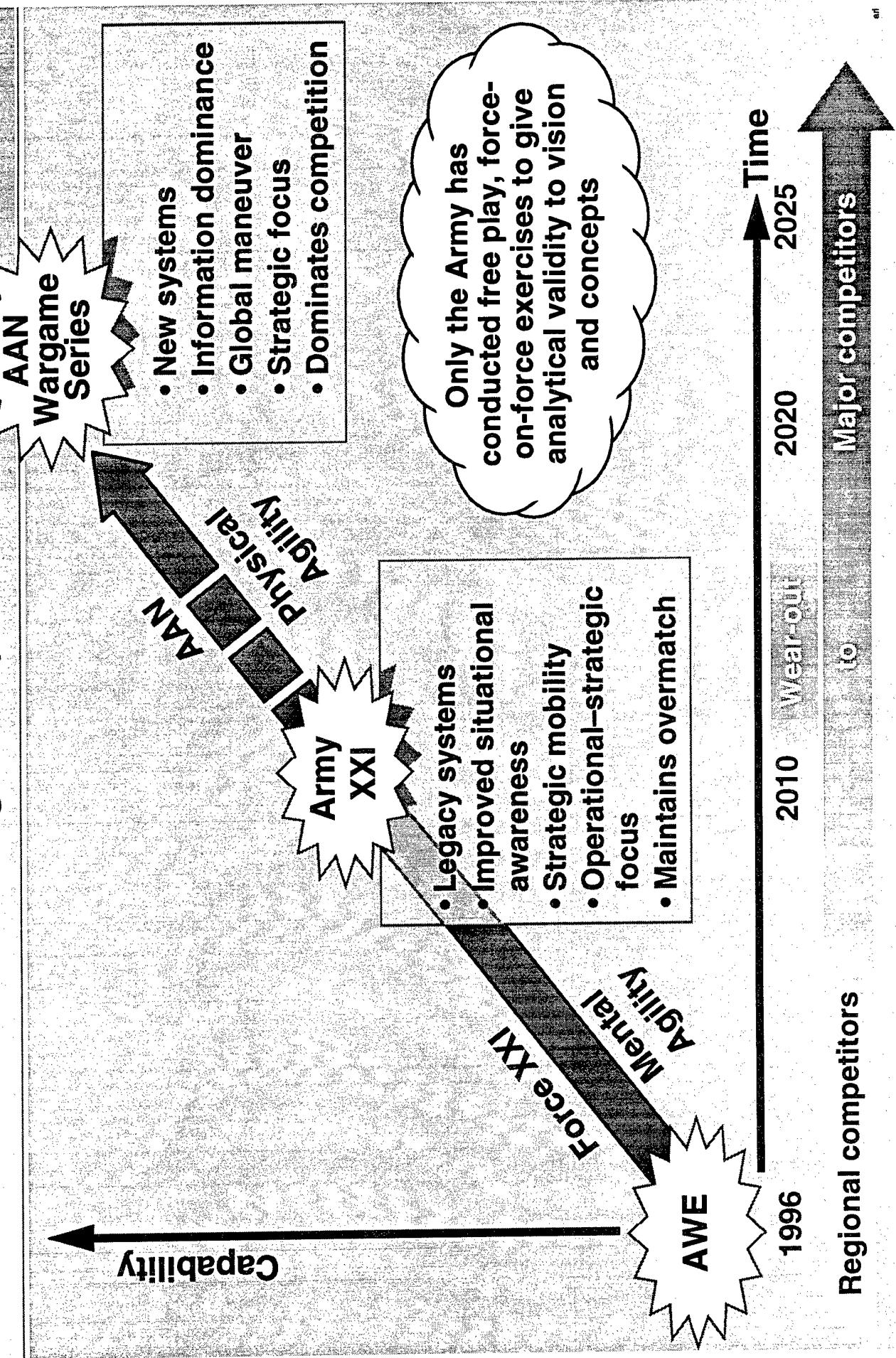


PROJECT AAN MISSION STATEMENT

Conduct broad studies of warfare to about the year 2025 to frame issues vital to the development of the U.S. Army after about 2010 and provide those issues to senior Army leadership in a format suitable for integration into TRADOC combat development programs.

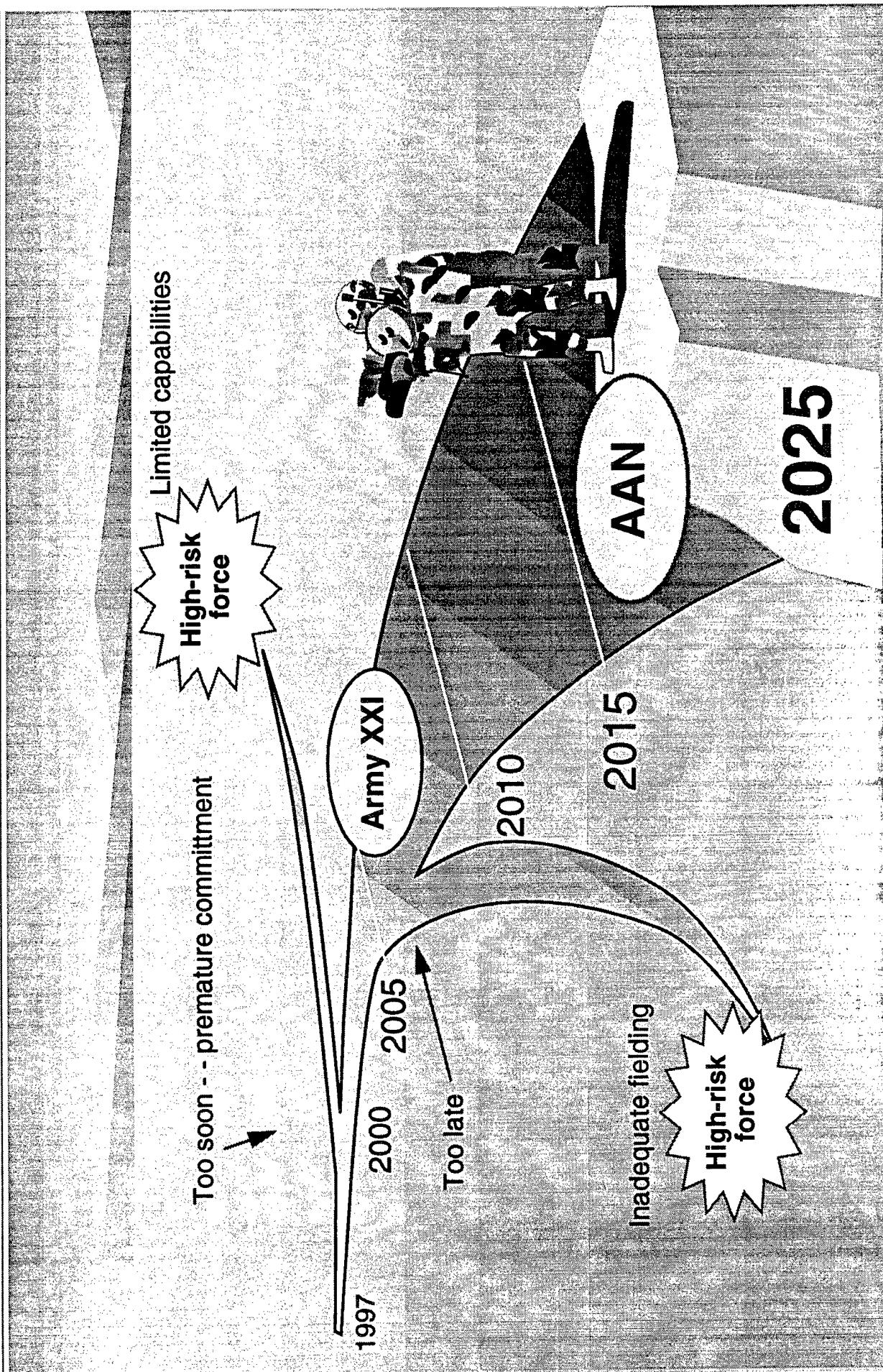


The Path to AAN Begins With the AWE and Passes Through Army XXI



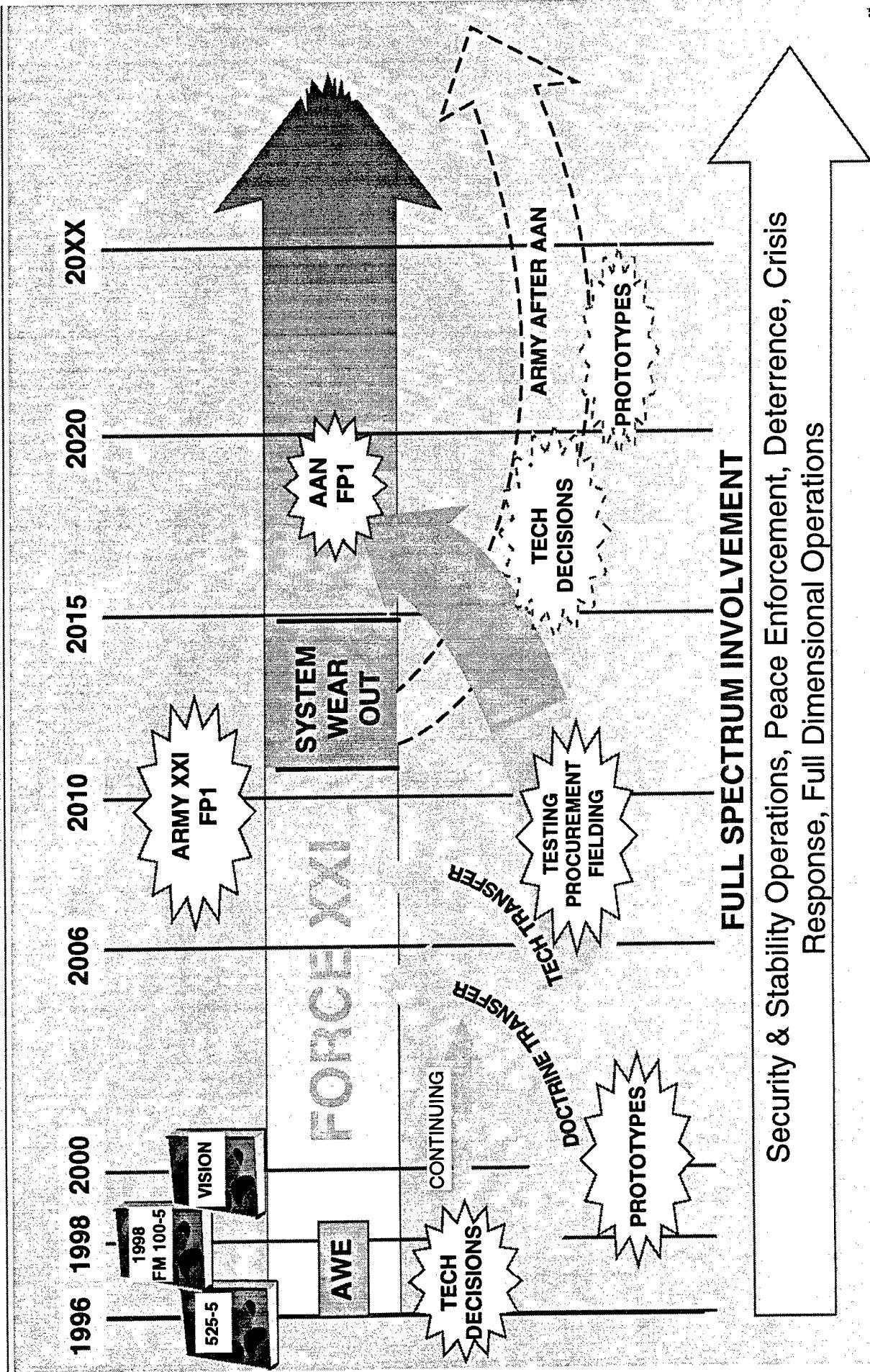


LOOKING BACK from THE FUTURE





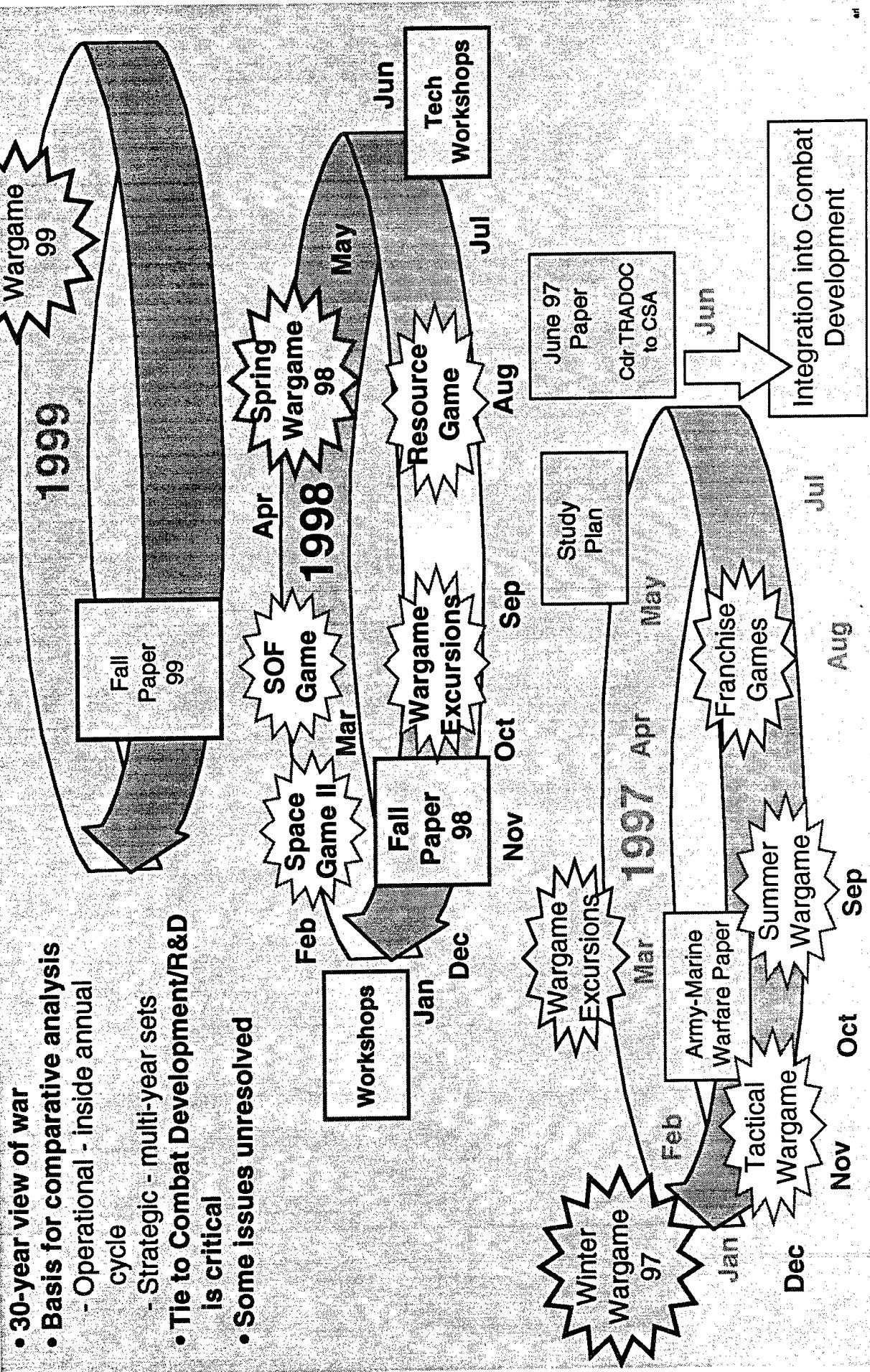
INFLUENCES ON THE ARMY'S FUTURE - GETTING TO AAN AND BEYOND



AAN: A CONTINUING PROCESS

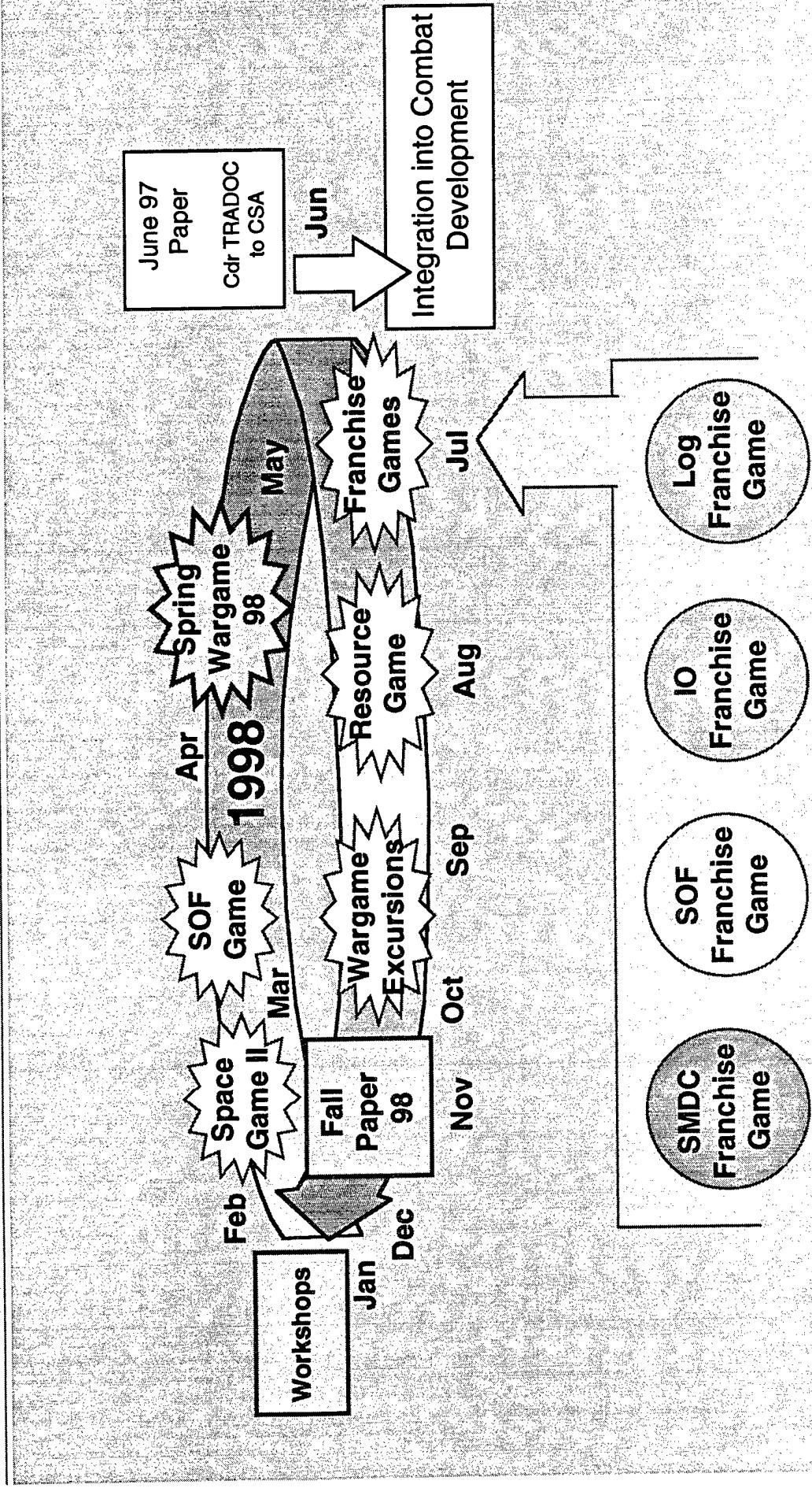


- 30-year view of war
- Basis for comparative analysis
 - Operational - inside annual cycle
 - Strategic - multi-year sets
- Tie to Combat Development/R&D is critical
- Some issues unresolved





EXPANDING THE PARTNERSHIP



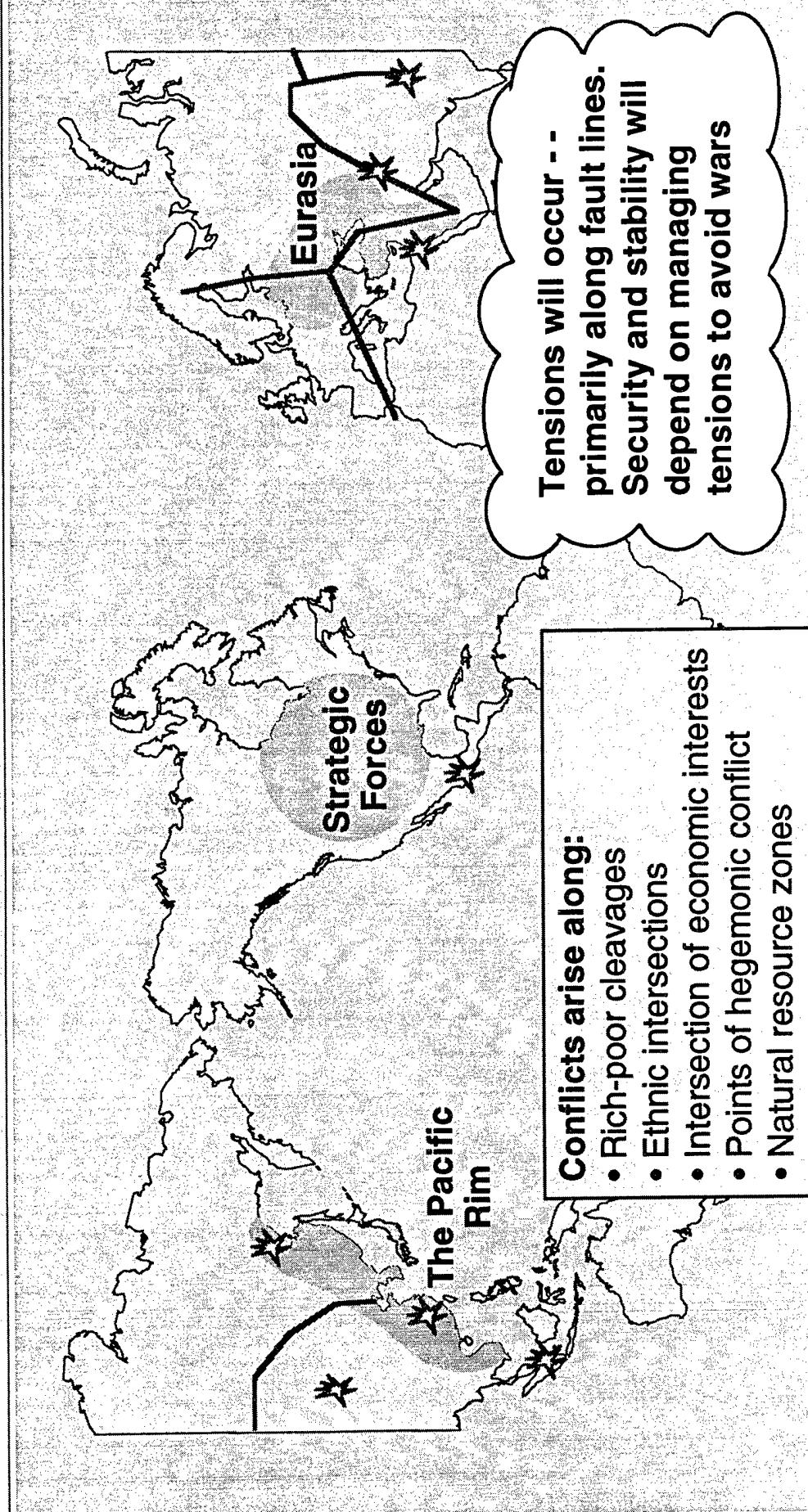
Franchises are AAN organizational partners who have agreed to conduct analytical excursions to further develop specific issue areas as feeds to the AAN wargame process.



AAN FUTURES RESEARCH FOCUSES INITIALLY ON FOUR AREAS CIRCA 2025:

- Probable geopolitical realities
- Human and organizational behavior
- Evolving military art
- Technology

GEOPOLITICS of 2025





America's Strategic Challenge Might Play Out Like This . . .

Threat

Constrained Competitors

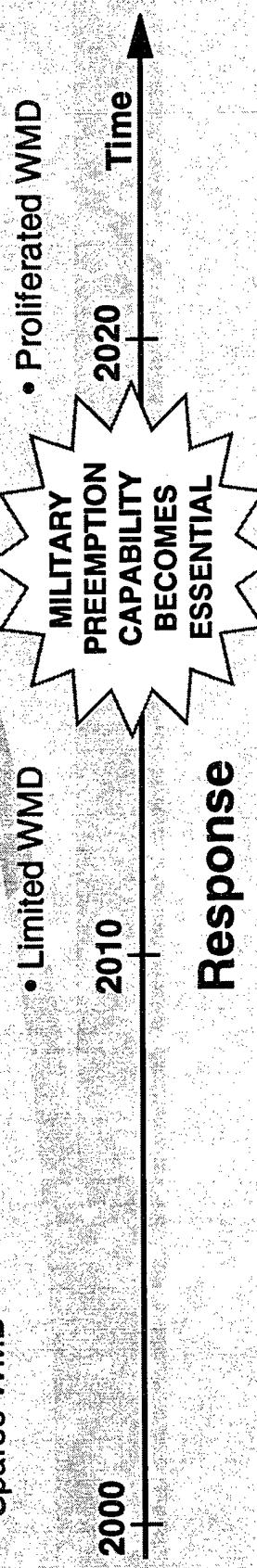
- Industrial-Age Forces
- Very Limited Precision
- Asymmetric Strategies
- Quasi-Professional
- Sparse WMD

Regional Competitors

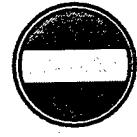
- Industrial-Age Forces
- Selective Precision
- Asymmetric Strategies and Investments
- Quasi-Professional
- Limited WMD

Major Competitors

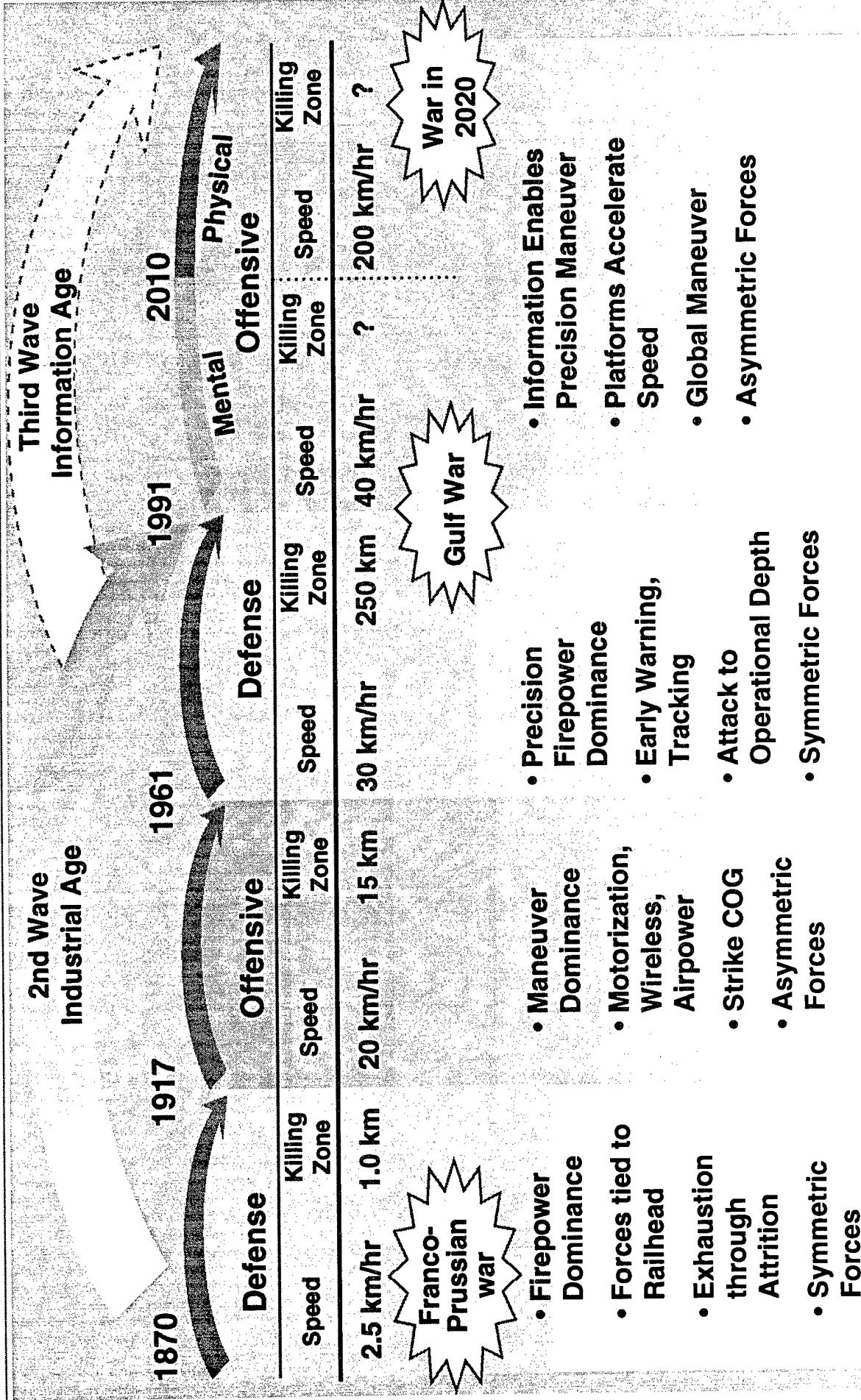
- Information-Age Forces
- Precision and Mass
- Hegemonic Ambitions, "Anti-Access" Strategy
- Professionalized
- Proliferated WMD



- Major War-Winning Capabilities
- Precision, Mass, Speed
- Strategic Maneuver
- Information Dominance
- Jointness to Interdependence
- Forward Presence
- 2-MRC Strategy
- Improved Forces
- Improved Strategic and Operational Mobility
- Improved Situational Awareness
- OOTW
- Tension Management
- Engagement and Enlargement
- Peacekeeping/Peace Enforcement



CHANGES in the ART of WAR FOLLOW TECHNOLOGY-DRIVEN CYCLES



WE CAN MANEUVER AND STRIKE TODAY WITHOUT SERIOUS CHALLENGE. BUT WHAT ABOUT DAY AFTER TOMORROW?



- We have already shown our hand . . .

- Fixation with precision strike
- Apparent lack of commitment over time
- Aversion to casualties
- Fear of collateral damage
- Sensitivity to domestic and world opinion

By 2025, an enemy's challenge will be to counter, not match, U.S. capabilities.

- Symmetric vs asymmetric

- The information revolution will quickly fill in the military-technical details

- A future enemy needs only the will and resources to develop his own means of precision strike

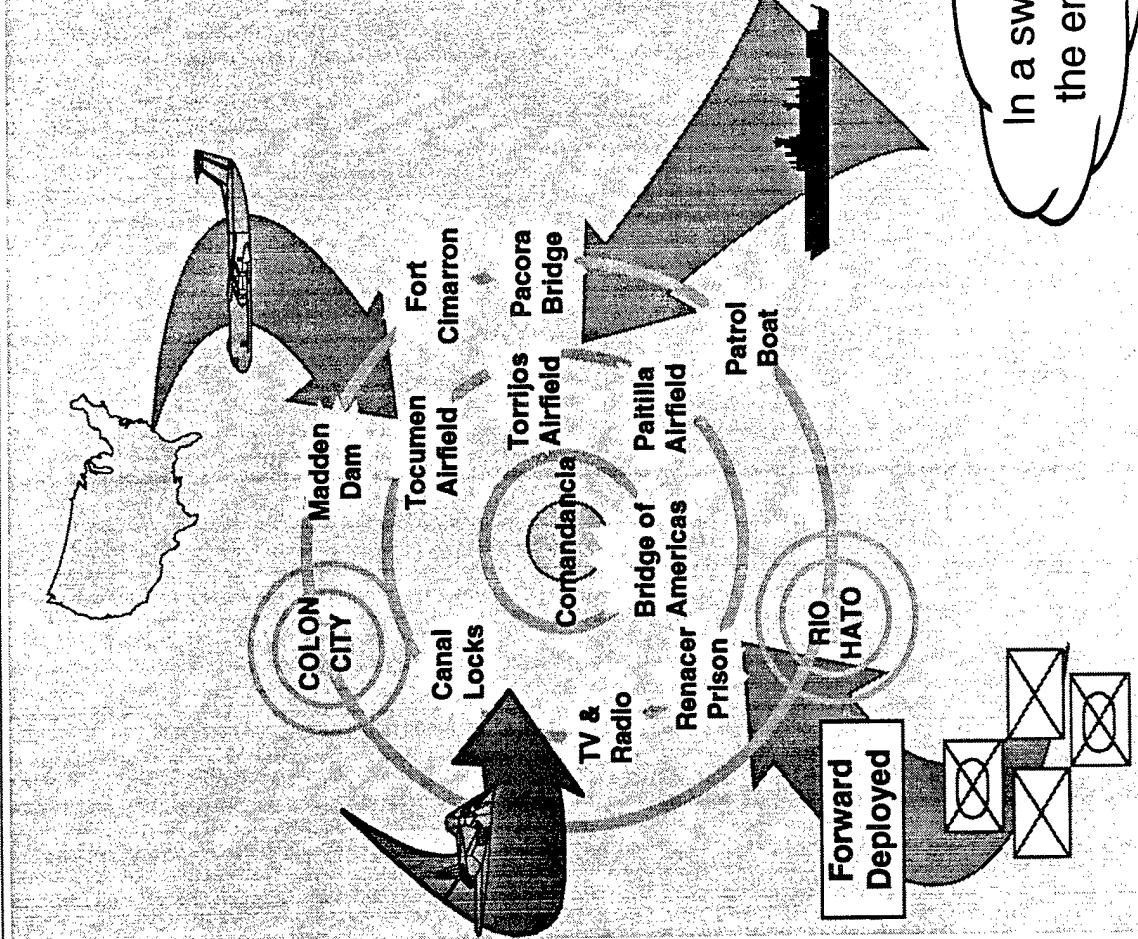
- Less sophisticated, but much larger strike capability coupled with geostrategic advantages may result in operational stalemate

BACK TO PATTERNS AND CYCLES... JUST CAUSE AS A WINDOW INTO THE FUTURE



- Center of Gravity: Will of the Opponent

- Speed
- Overmatch
- Limited Killing, Damage
- Information Dominance
- Assured Land Control
- Assured Termination
- Strategic Reach
- Strategic Convergence
- Overseas Presence
- Dispersed Operations
- Urban Warfare
- Melding of Land, Air, Sea, and Space in Joint Operations



NATURE of FUTURE MILITARY ENVIRONMENT



- Radically increased lethality
- Radically increased mobility
- Translucent battlespace
- Wider range in size and nature of potential conflicts
- Global information environment
- Expansive urbanization



FUTURE MILITARY ENVIRONMENT IMPERATIVES

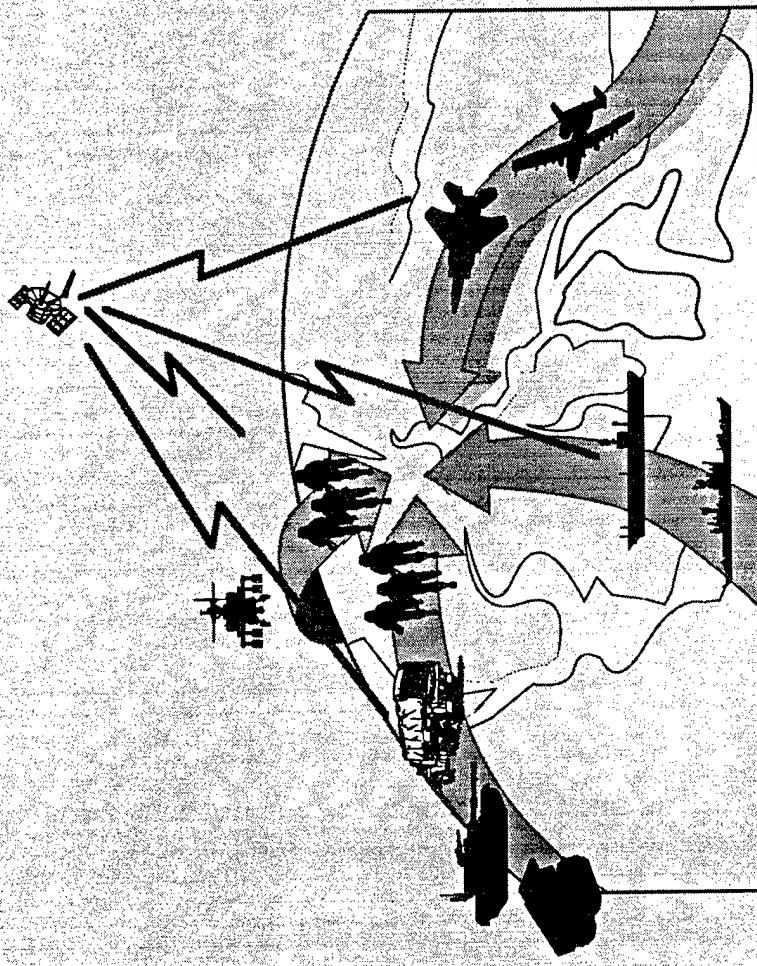
Speed . . . to Exploit Knowledge

- Forces must move to survive and succeed
 - High speed, continuous, day and night
- High-tempo operations
- Pulsed operations
- Focused logistics
- Agile, high operational transition capability
- Adaptive, full-spectrum force
 - Capable of altering size and composition in stride to align with changing METT-T
- A rich menu of options to fit anywhere along the operational continuum

Global Strategic Maneuver -- circa 2025



- Power projection from all points on the globe converge and paralyze enemy
- Simultaneous convergence of overwhelming land, air, space, and sea forces
- Overseas presence quickens global maneuver
- Being "First with the Most" reduces risk and begins process of psychological domination

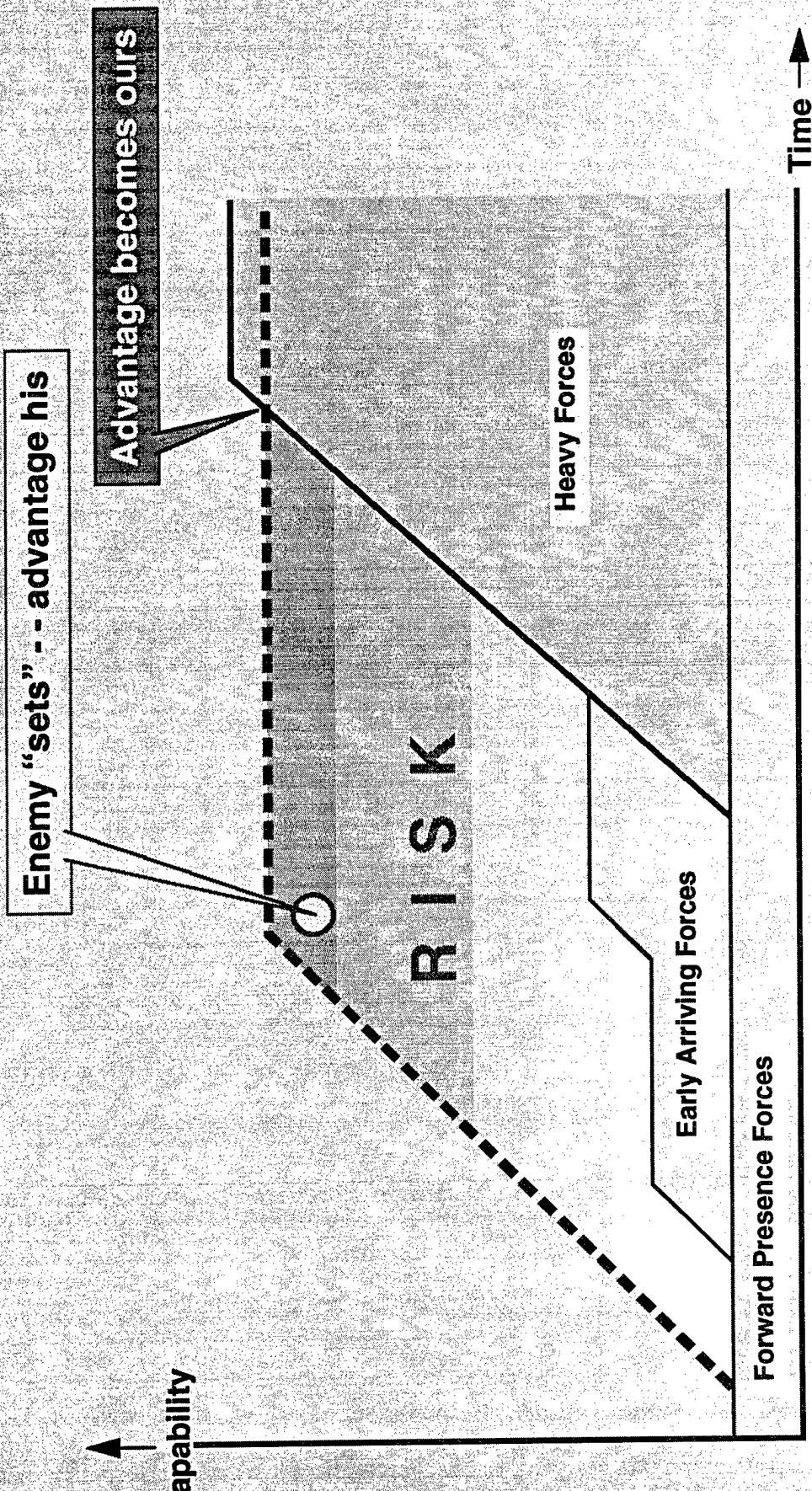


**Seize initiative,
build momentum . . . an image of uncontested
competence and unstoppable force**

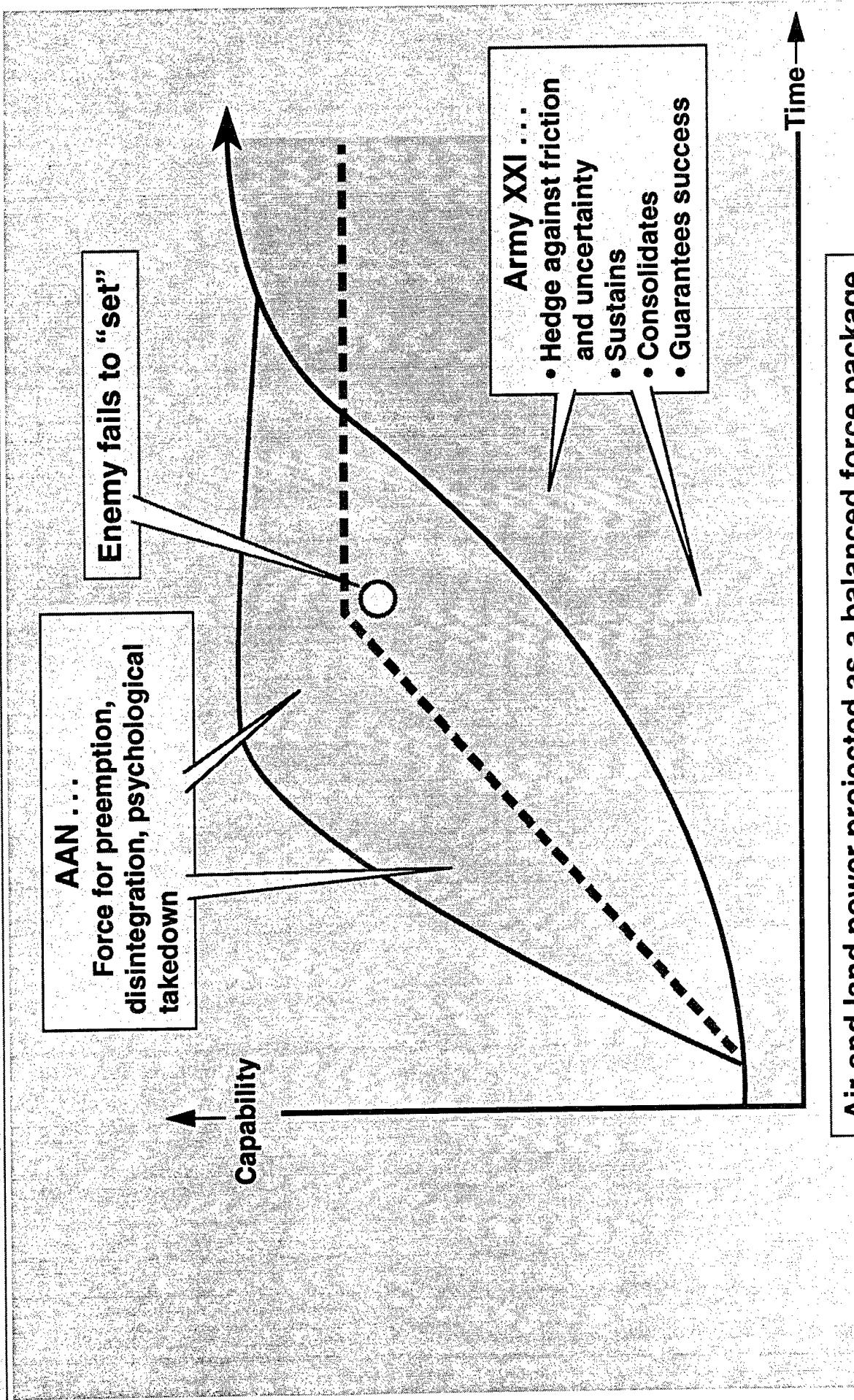
**The Goal: A globally self-deployable force capable of striking directly at
strategic and operational centers of gravity**



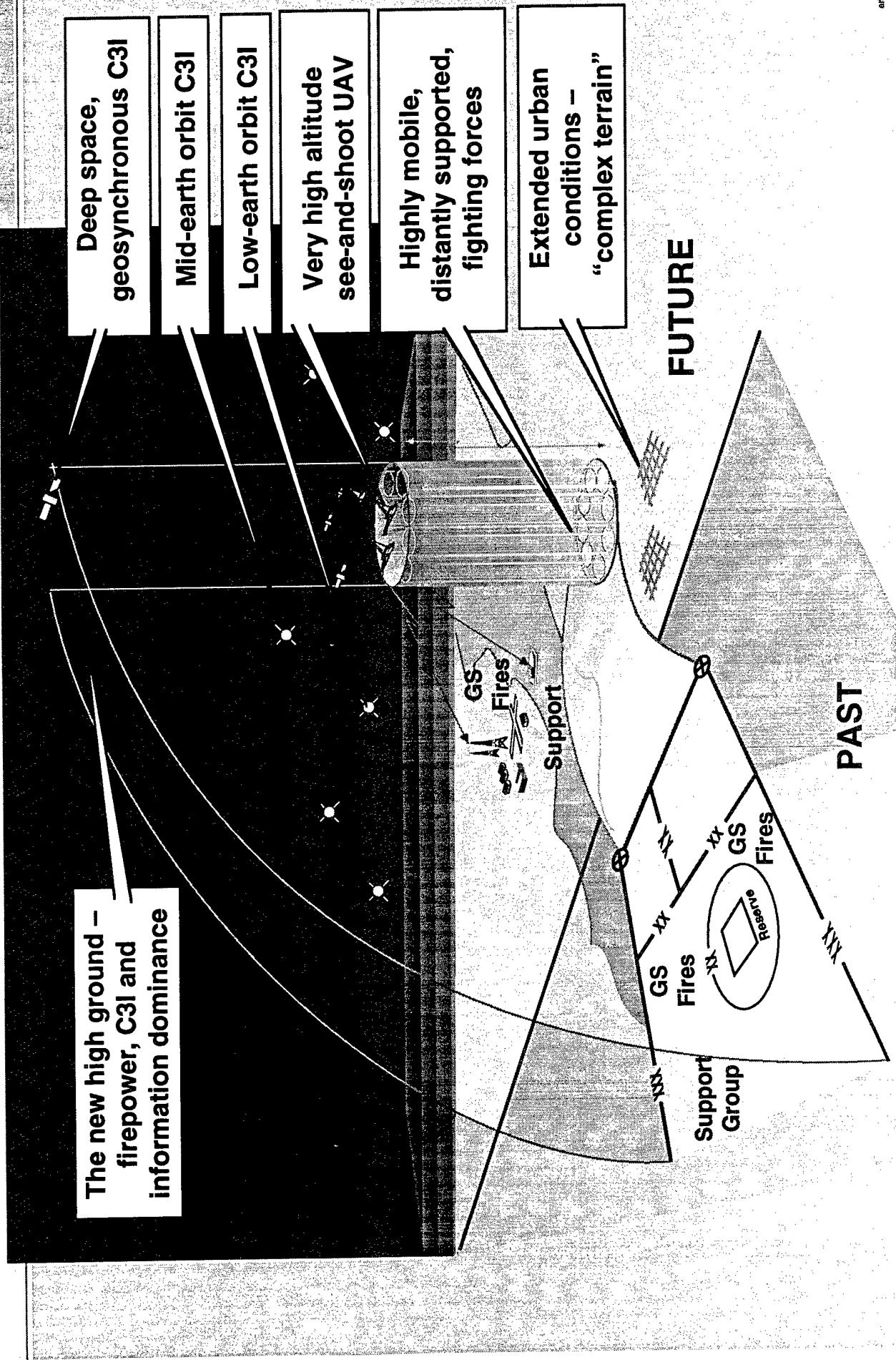
Power Projection Today: Slow Arrival Allows Enemy to "Set": Reaction vice Preemption



Power Projection in 2020: Preemption vice Reaction

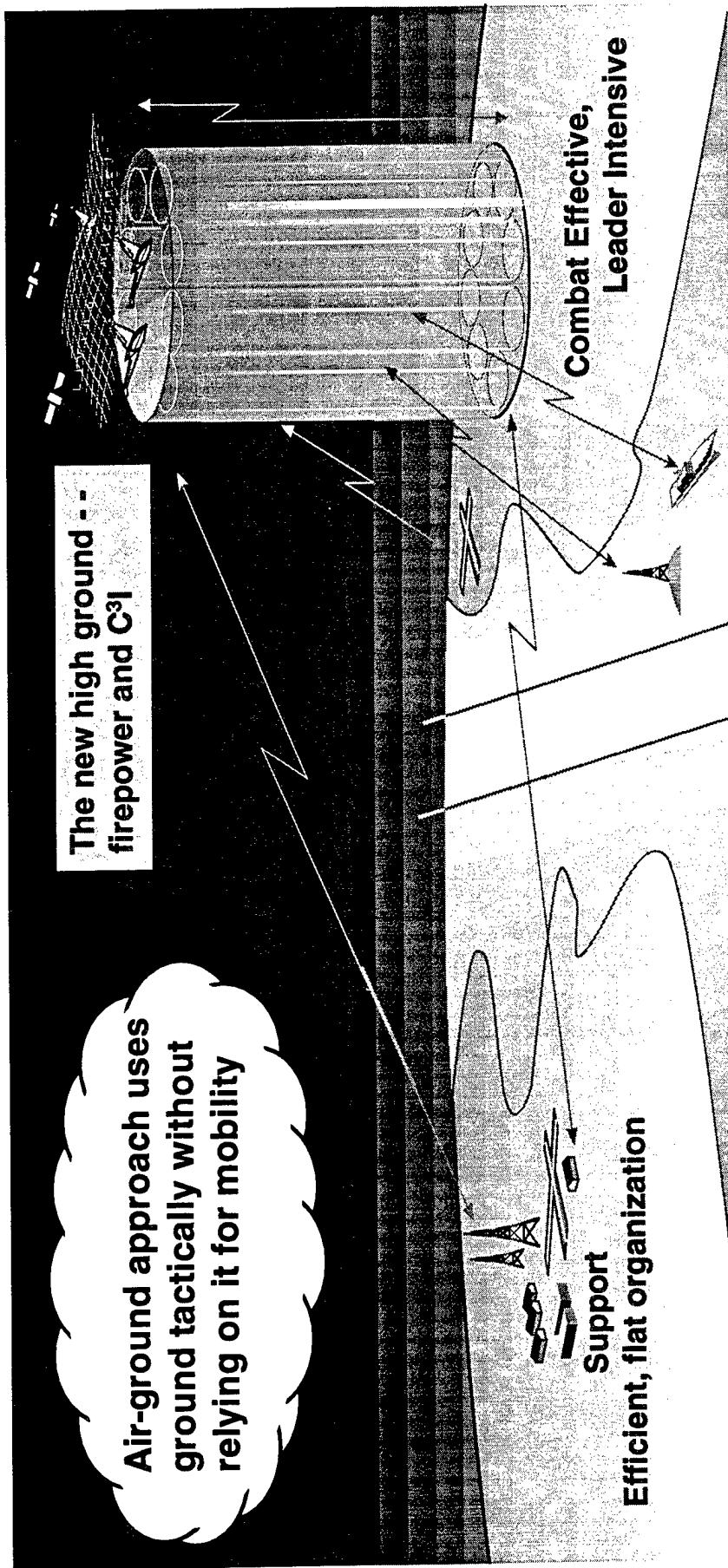


AAN – FROM LINEAR TO VERTICAL



OPERATIONAL CHARACTERISTICS of AAN (20XX)

... A BALANCED APPROACH to WARFARE

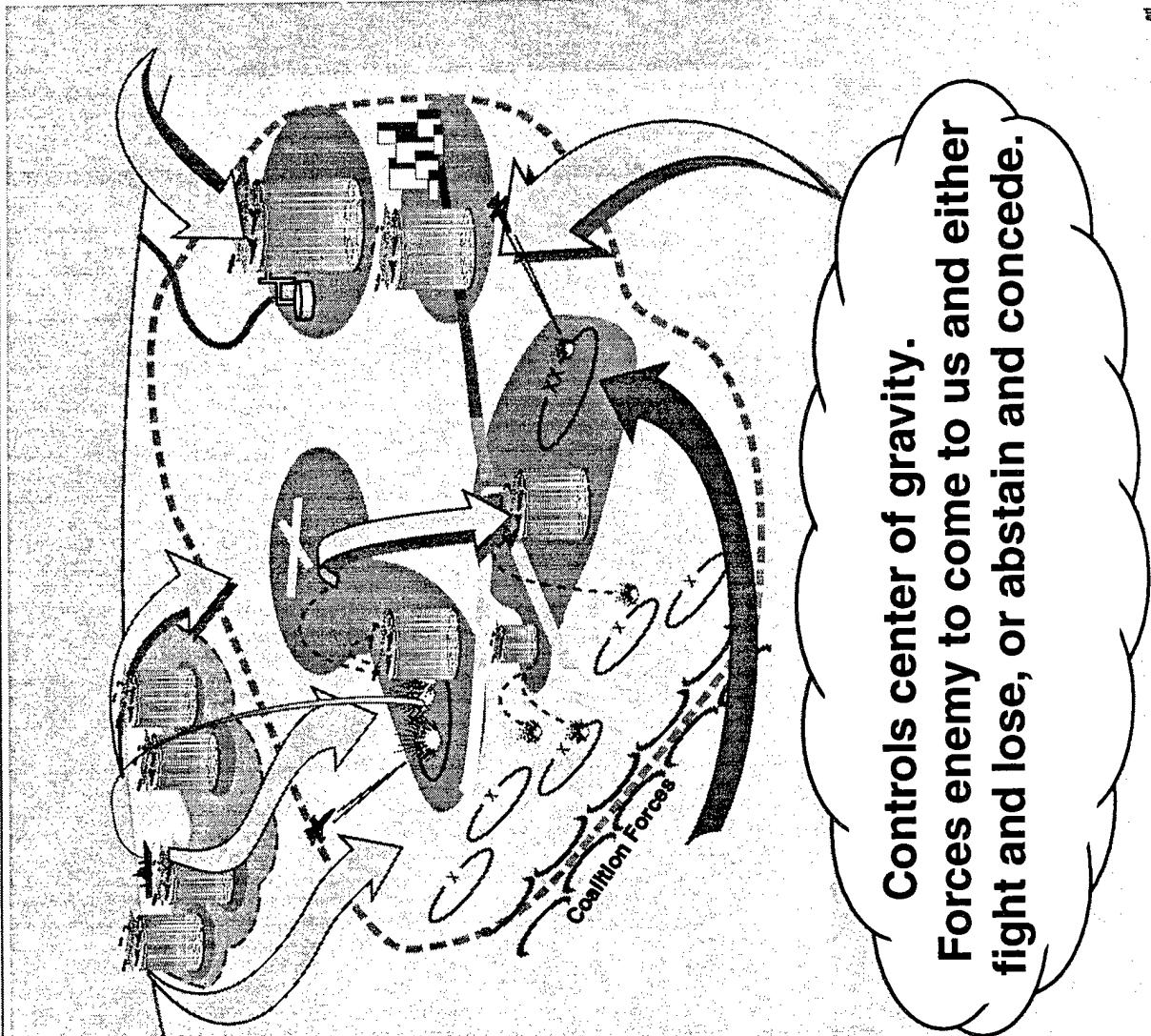


- **From joint to interdependence**
- **Autonomous operations for weeks**
- **All operating systems resident within battle force**
- **“Reach out” for combat functions (Fires, C², Logistics)**
- **Self-protection through movement, organic weapons, low-observables, and situational awareness**
- **Engage enemy with information, organic, and inorganic weapons**
- **Pull-Down Data – from the Internet**

HOW LANDPOWER MIGHT BE APPLIED

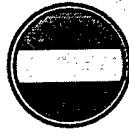


- Strikes directly at strategic and operational centers of gravity
- Speed, reach and overwhelming tempo = physical and psychological domination
- Merges heavy and light
- Establishes and assures control; long-term sustained staying power
- Hybrid force: mix of mature Force XXI units and AAN units
- Organic integration of air and ground capabilities at lowest level



Controls center of gravity.

Forces enemy to come to us and either fight and lose, or abstain and concede.



HUMAN AND ORGANIZATIONAL CHARACTERISTICS OF AAN (2025)



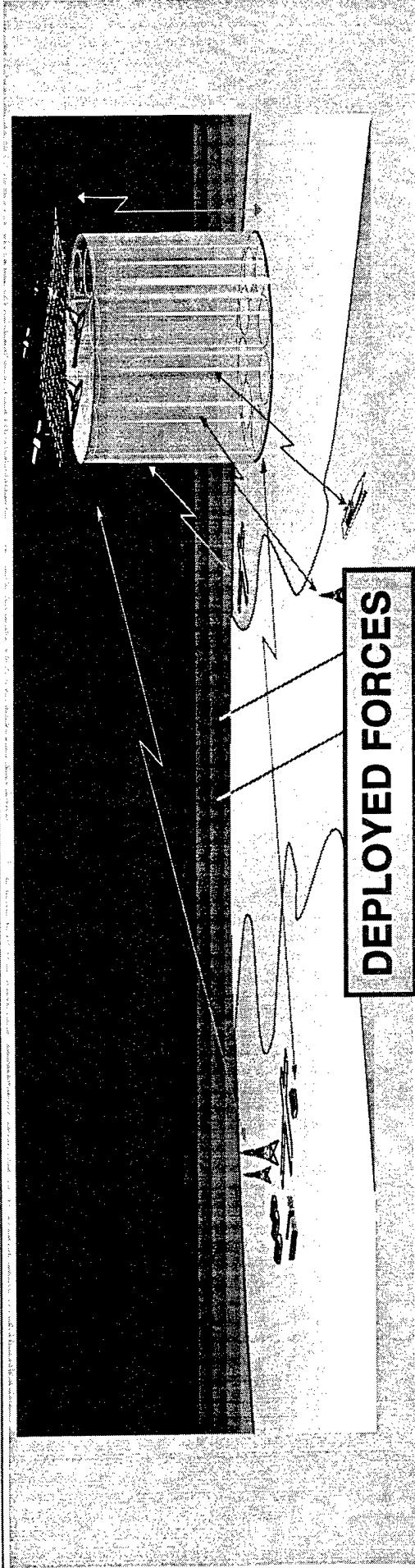
New Geopolitical Realities and Development in Military Art Present New Challenges for Soldiers and Units

- Threats more asymmetrical and competent
- “Come-as-you-are” wars more likely
- Radically compressed planning and execution times
- Improved technology both permits and demands greater dispersion
- Split-based operations and smaller theater foot print
- Increased demand for mental agility and adaptability

War will continue to be violent and lethal



HUMAN AND ORGANIZATIONAL CHARACTERISTICS OF AAN (2025)



LIKELY CHALLENGES

- Technology will likely provide needed information
 - Difficulty will be analyzing and using it
- Problem solving while under tremendous stress
 - Complex problems with many moving parts
 - Fear and anxiety
 - Sleeplessness and fatigue
 - Severe time constraints
- Must quickly & precisely implement plans
 - Convert knowledge into plans and action
 - Speed and enemy will generate fog and friction
 - Organization will be widely dispersed

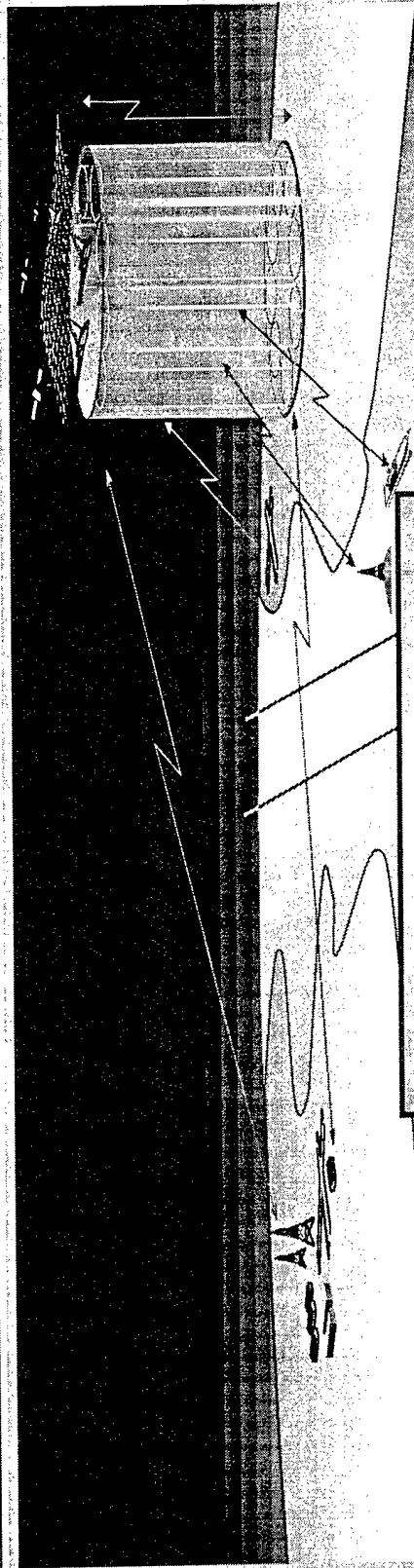
POTENTIAL SOLUTIONS

- Soldiers must have both skills and confidence
 - Longer service
 - Low unit turbulence
 - Continued small span of control
 - Continued heavy emphasis upon doctrine & drill
 - Psychological hardening
 - Unit cohesion and training
 - Assessment and selection
 - Systems designed within limits of human cognition
 - Highly trained, multi-skilled, and mature soldiers

Requires revolutionary change to traditional personnel and management approaches



HUMAN AND ORGANIZATION CHARACTERISTICS OF AAN (2025)



NON-DEPLOYED FORCES

LIKELY CHALLENGES

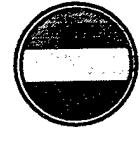
- Many challenges will mirror deployed forces
 - Technology will likely provide needed information
 - Complex problems with many moving parts
 - Severe time constraints
 - Must quickly & precisely implement plans
 - Organization will be dispersed
 - Speed and enemy will generate fog and friction

POTENTIAL SOLUTIONS

- Larger span of control
- Comprehensive, integrated, worldwide databases
- Greater use of civilian business practices
 - Decentralized management
 - Greater individual specialization
 - Heavily civilianized/contracted force
 - Increased lateral entry
 - Direct producer-to-user distribution

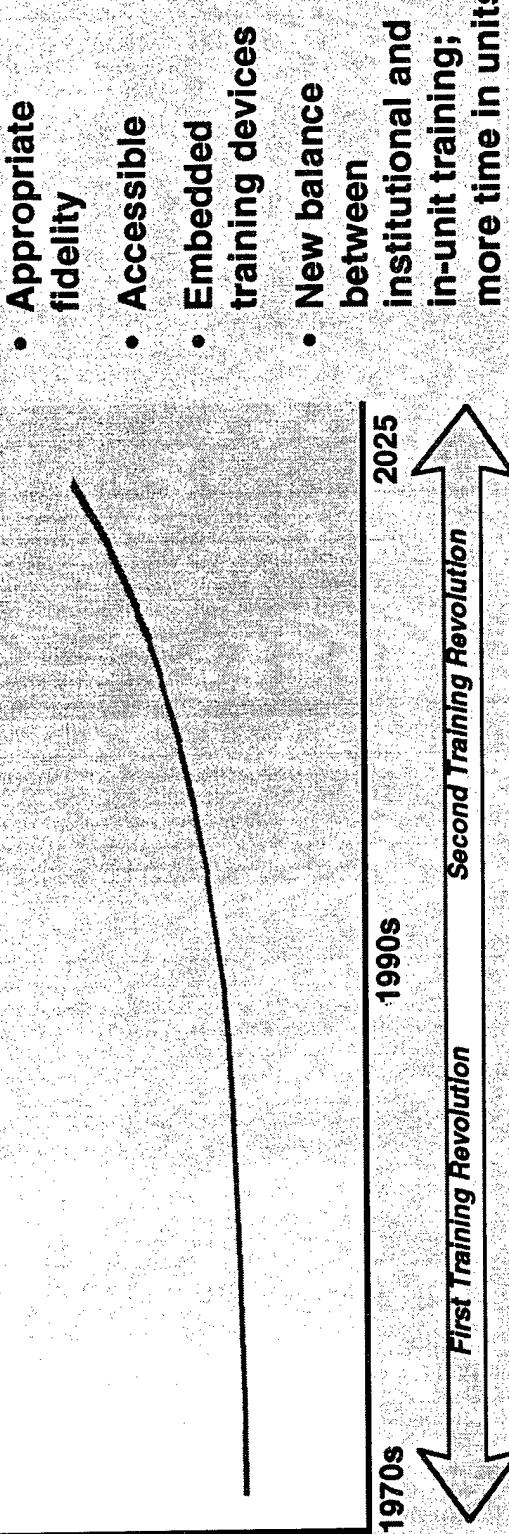
- Some challenges will be different
 - Greater personal safety
 - Must minimize logistical footprint in theater and maintain margins of safety

Requires revolutionary change to traditional personnel and management approaches

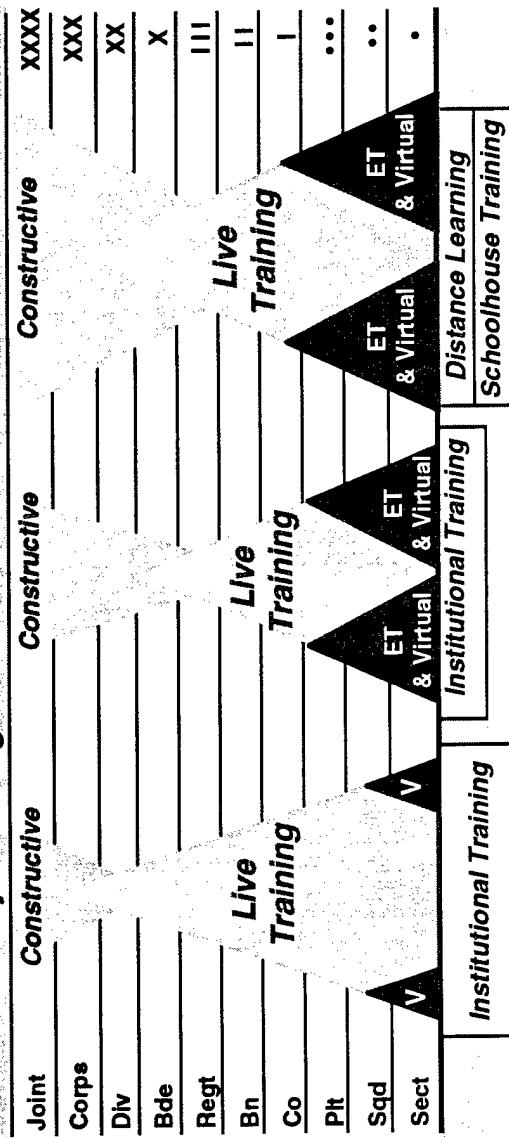


Quality and Frequency of Training Will Continue to Improve

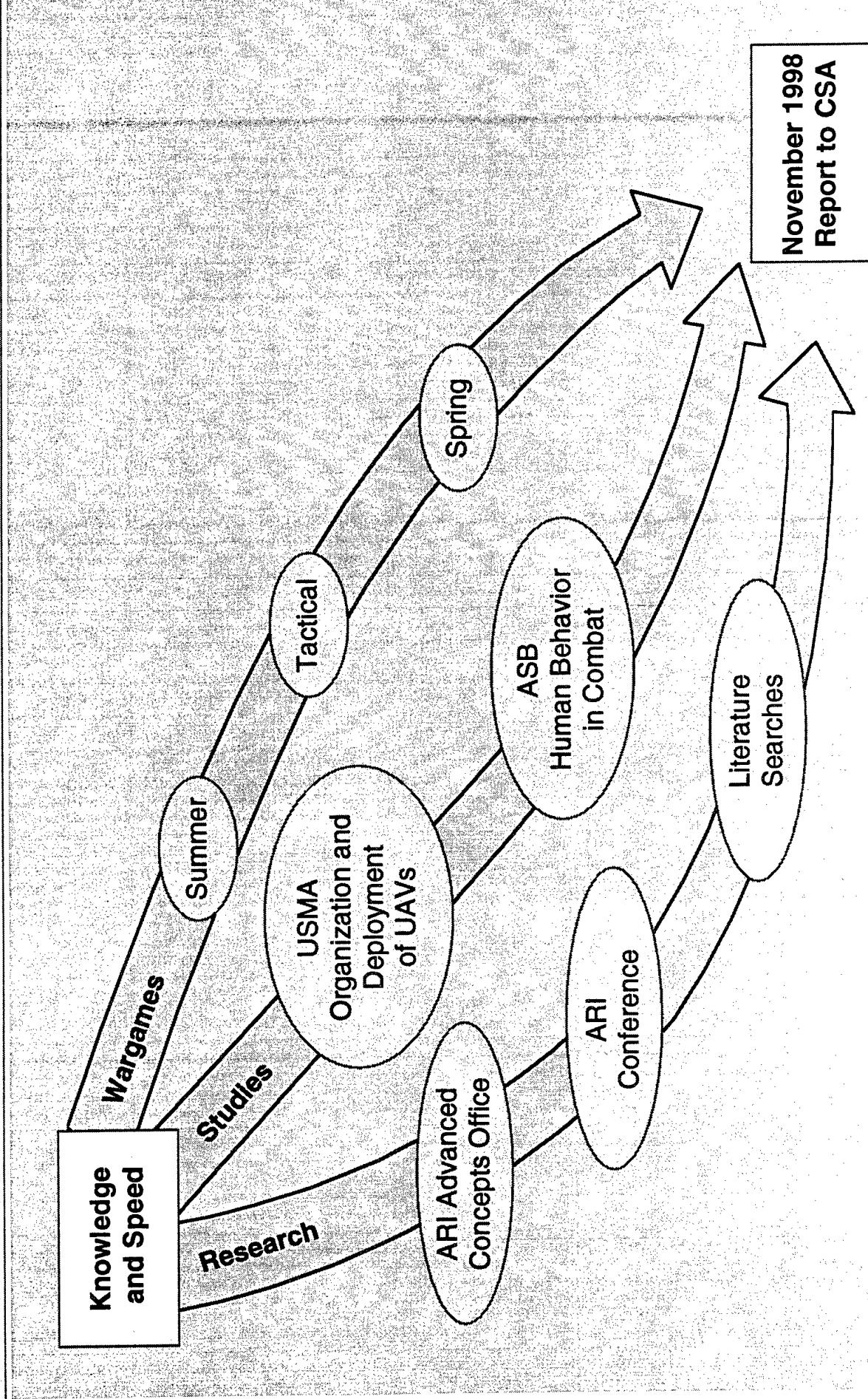
Quality and Frequency of Training



Yesterday's Training Today's Training Tomorrow's Training



Human and Organizational Behavior Study Plan



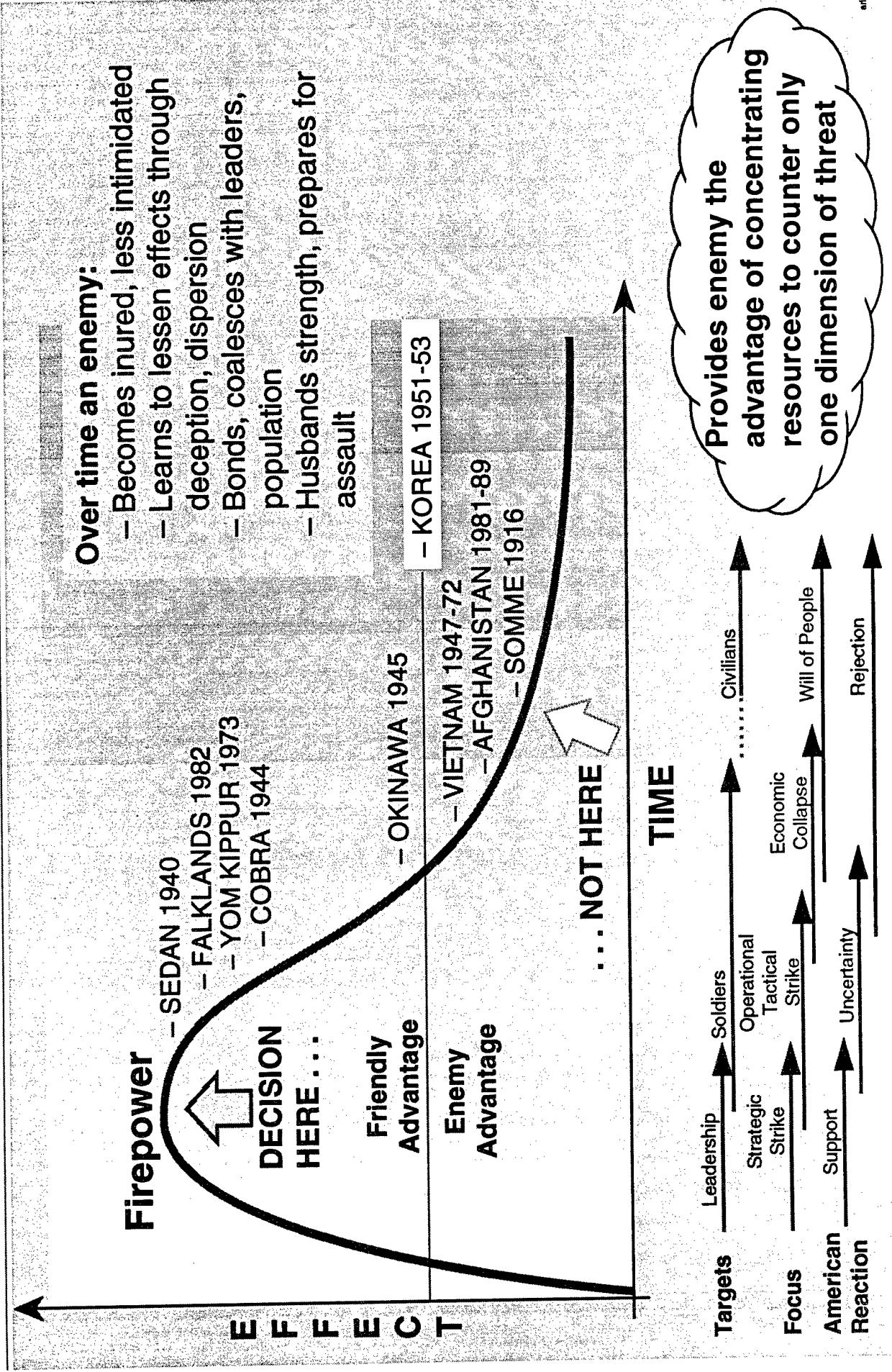


Human and Organizational Behavior Study Objectives

- Better understand human capacities and limits and their impact upon organizational structure, doctrine, and battlefield performance
- Given greater emphasis upon speed, mobility, and information, investigate the complexity that will face future decision-makers, planners, and fighters
- Examine the training and education needs of future officers and senior NCOs and how the Army might meet those needs
- Examine the roles, missions, and composition of the Reserve Components in 2020

.....**backups.....**
.....**backups.....**
.....**backups.....**
.....**backups.....**
.....**backups.....**
.....**backups.....**

FIREPOWER-CENTERED APPROACH: UNNECESSARY RISK. FIREPOWER EFFECT DECLINES OVER TIME



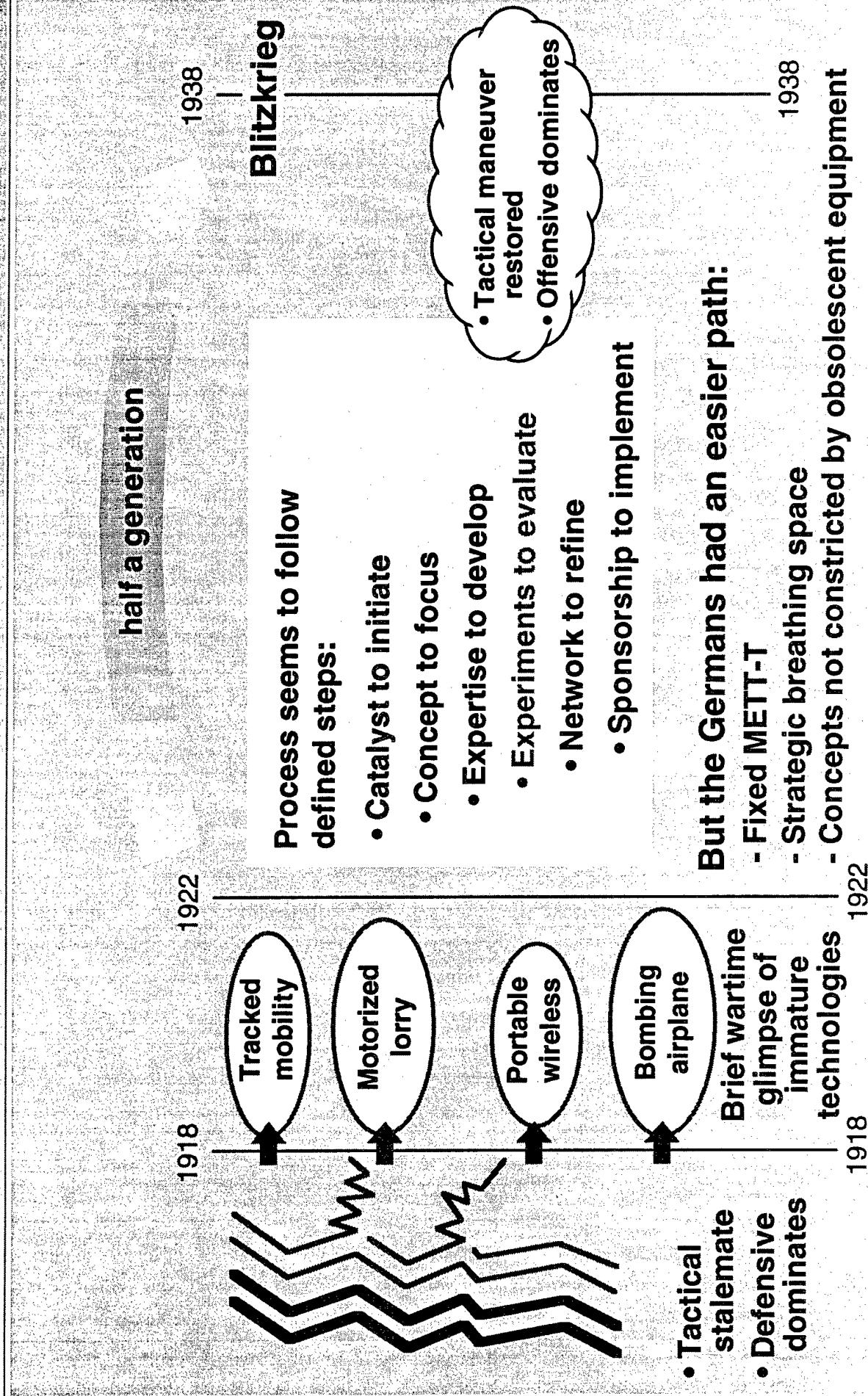


KNOWLEDGE AND SPEED

- **Strategic Speed**
 - Global maneuver begins process of psychological collapse
- **Avoid attrition warfare**
 - Cross the deadly zone intact - speed, simultaneity
 - Protection derived from a shield of knowledge (our inheritance from Force XXI)
- **Operational – Tactical Speed**
 - Dominant maneuver and precision engagement - restore the balance
 - Psychological collapse of enemy's will to resist
 - Unprecedented operational reach
- **Protect and sustain in bare-based environment**
 - Sever (or shrink) the logistical umbilical cord – our technological long pole
- **Expansible**
 - Wars, not just battles
 - Quantity has a quality all its own – size counts
 - Long-term physical presence, staying power



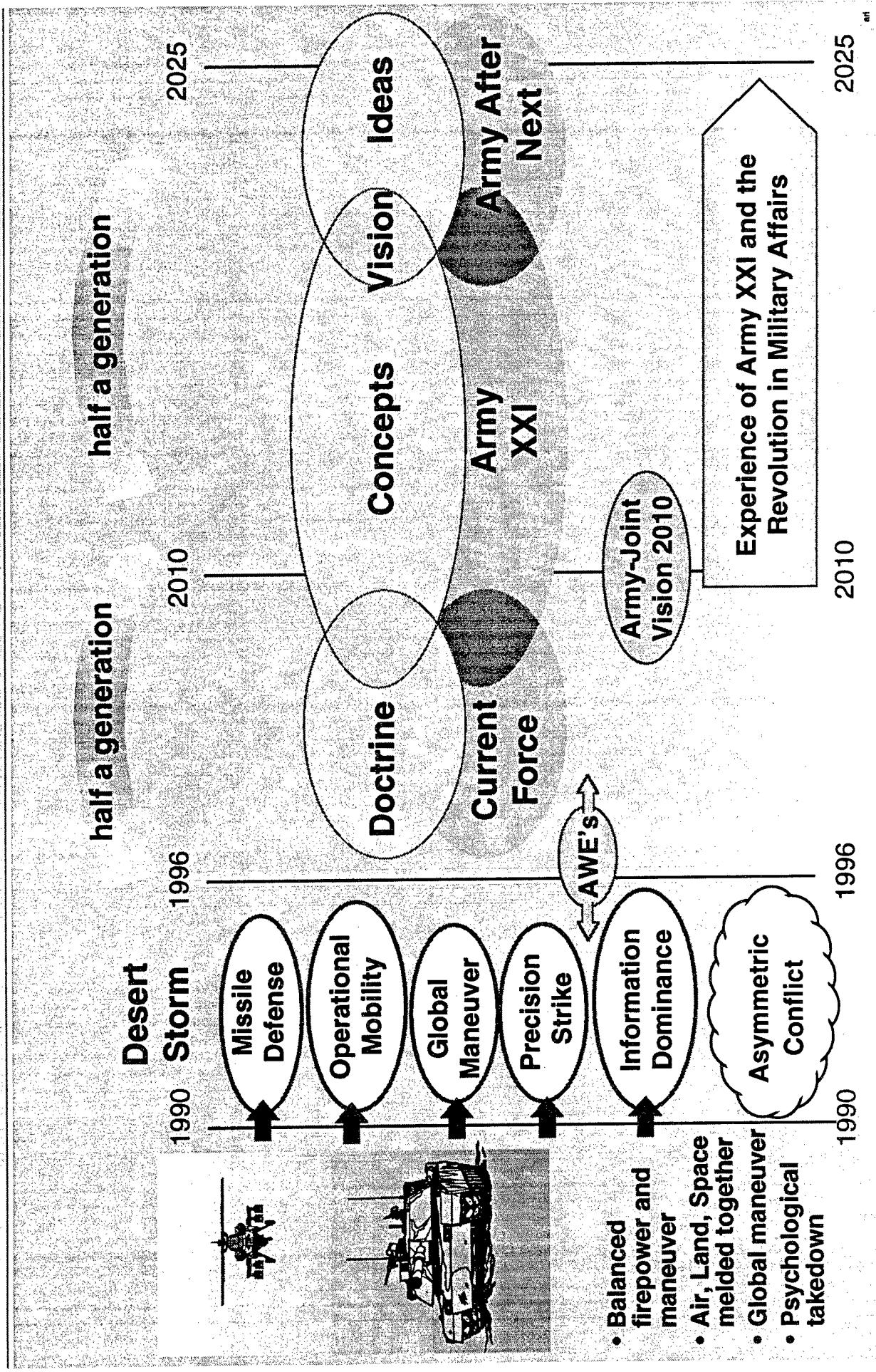
THE PROCESS OF DOCTRINAL CHANGE TO ACCOMMODATE NEW TECHNOLOGY FOLLOWS A CLEAR PATH. GERMANS : BLITZKRIEG

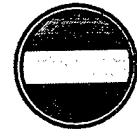




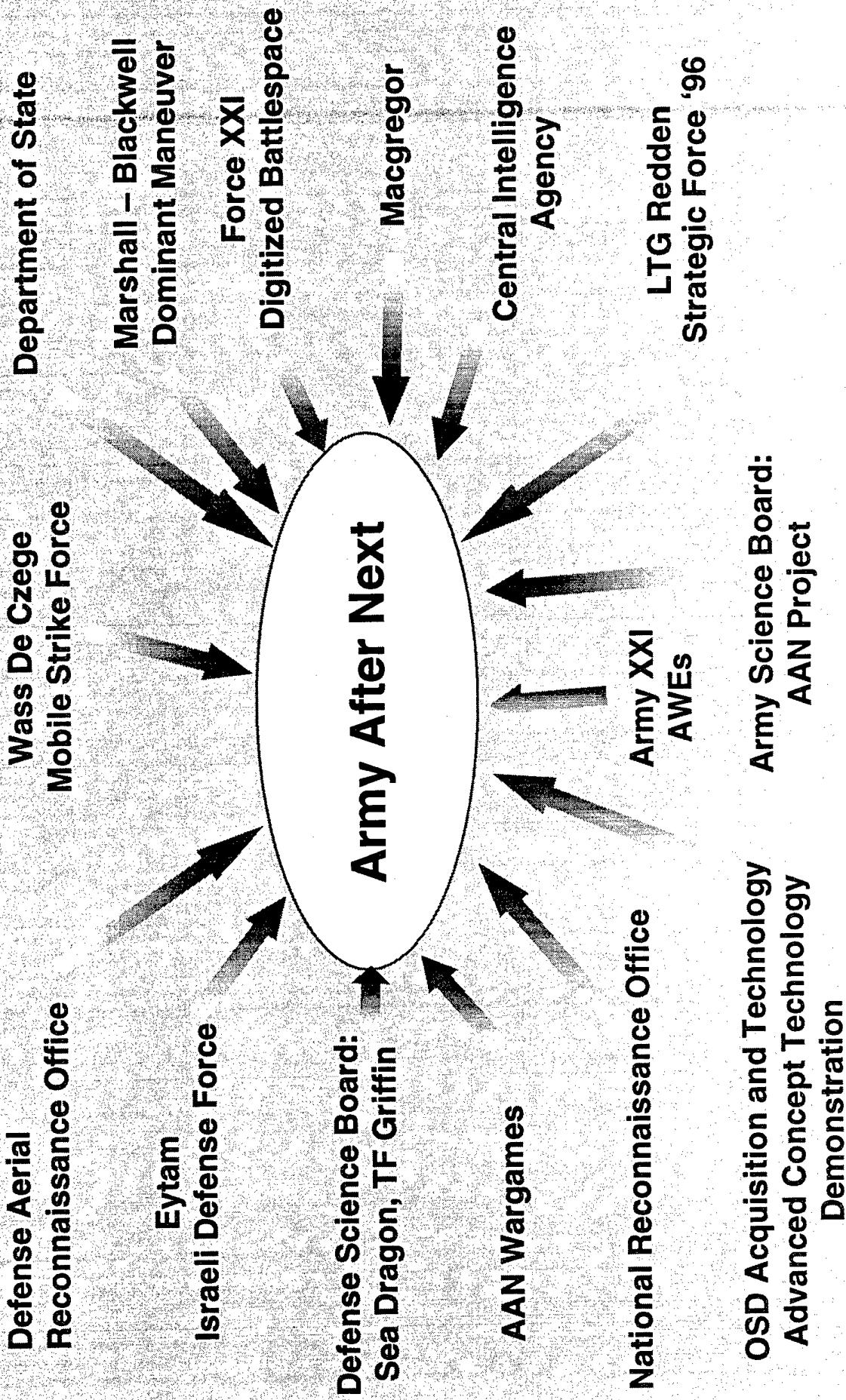
THE PATH AND PATTERNS STRETCH INTO THE FUTURE

Army XXI and Army After Next



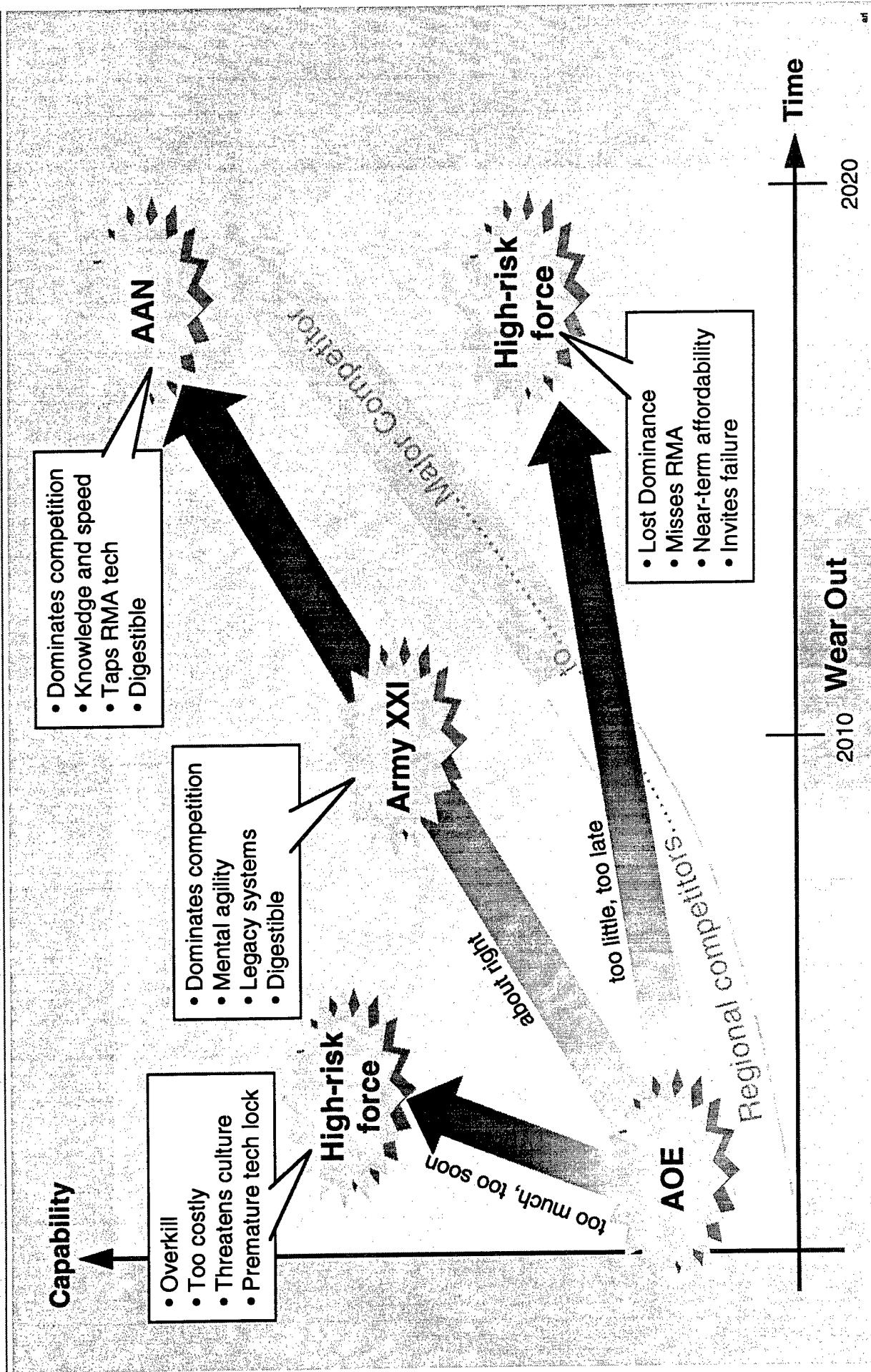


INTELLECTUAL CONVERGENCE GIVES US THE CONFIDENCE THAT WE'RE ABOUT RIGHT





Rate of Change Determined by Affordability and Acceptability





THE PATH AHEAD in the BATTLE of IDEAS

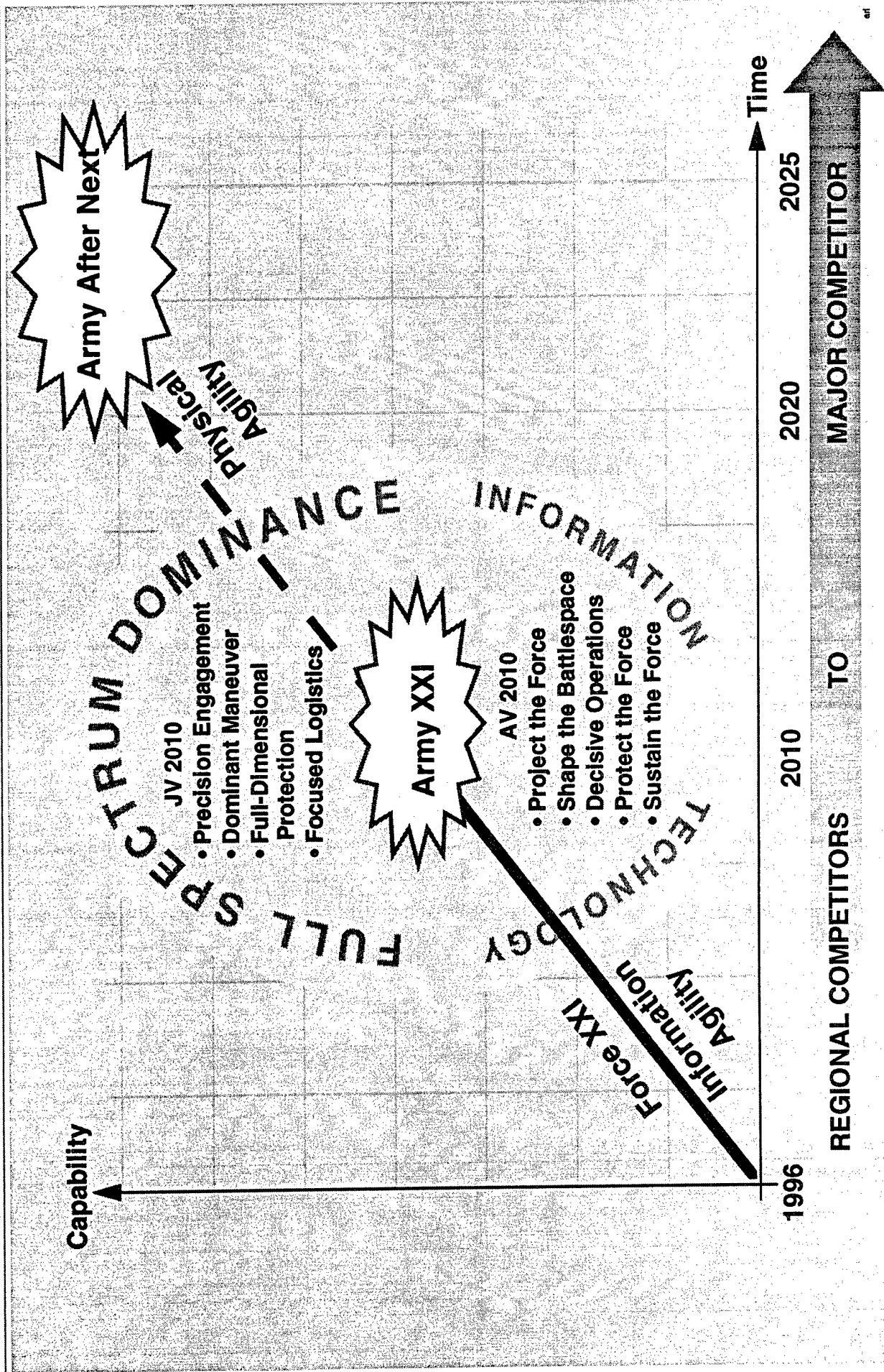
Understanding Future Warfare

- A process exists that facilitates institutional change
- Art of War evolves in predictable cycles and patterns
- Balance between Dominant Maneuver and Precision Engagement
- Must understand the dynamic of symmetric and asymmetric warfare across the full spectrum of conflict

Gaining Insights Into the Solution

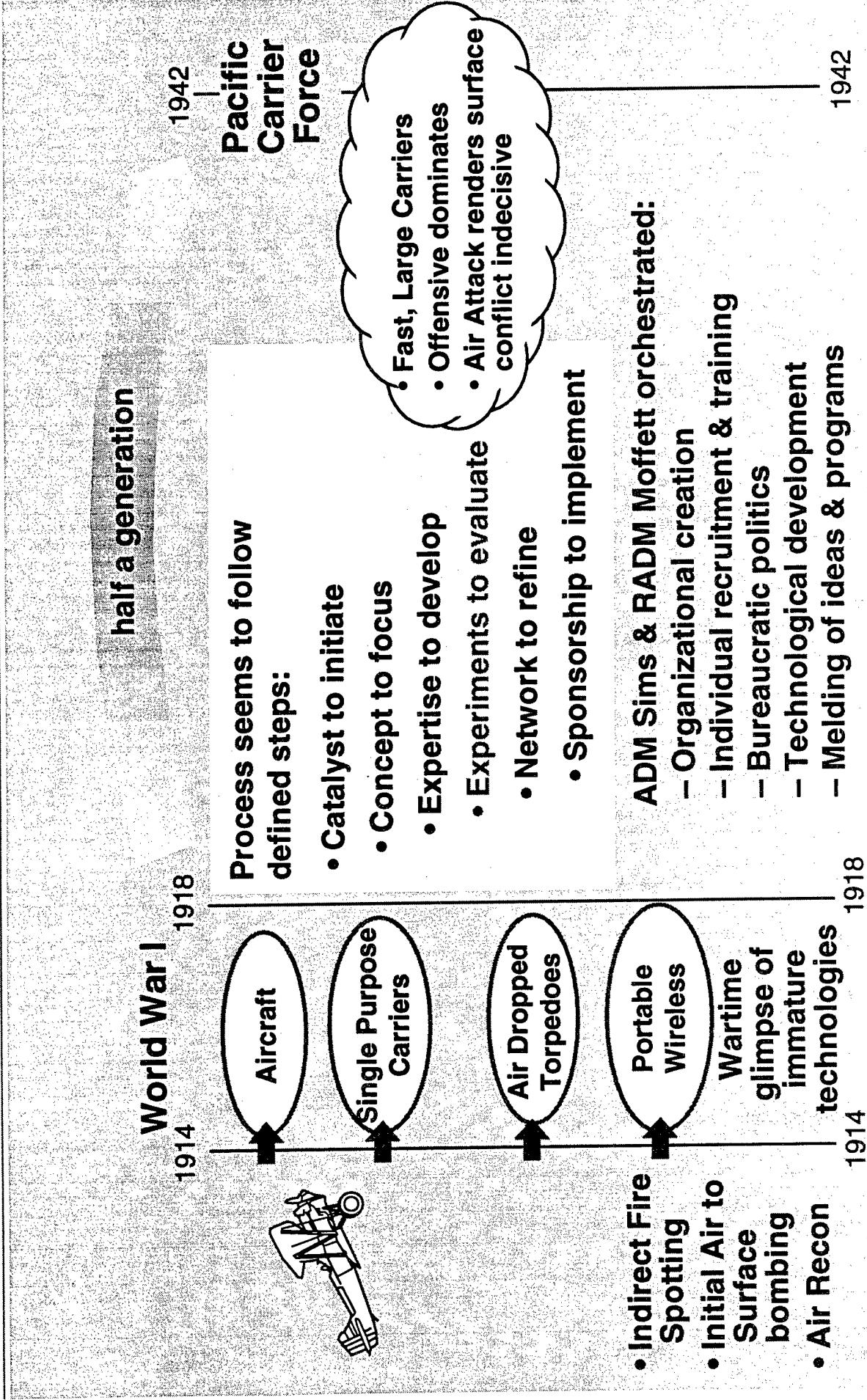
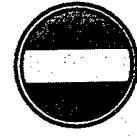
- Emerging vision of the Army After Next

THE PATH TO AAN MUST PASS THROUGH FORCE XXI



PROCESS THE SAME REGARDLESS OF SERVICE OR CIRCUMSTANCES

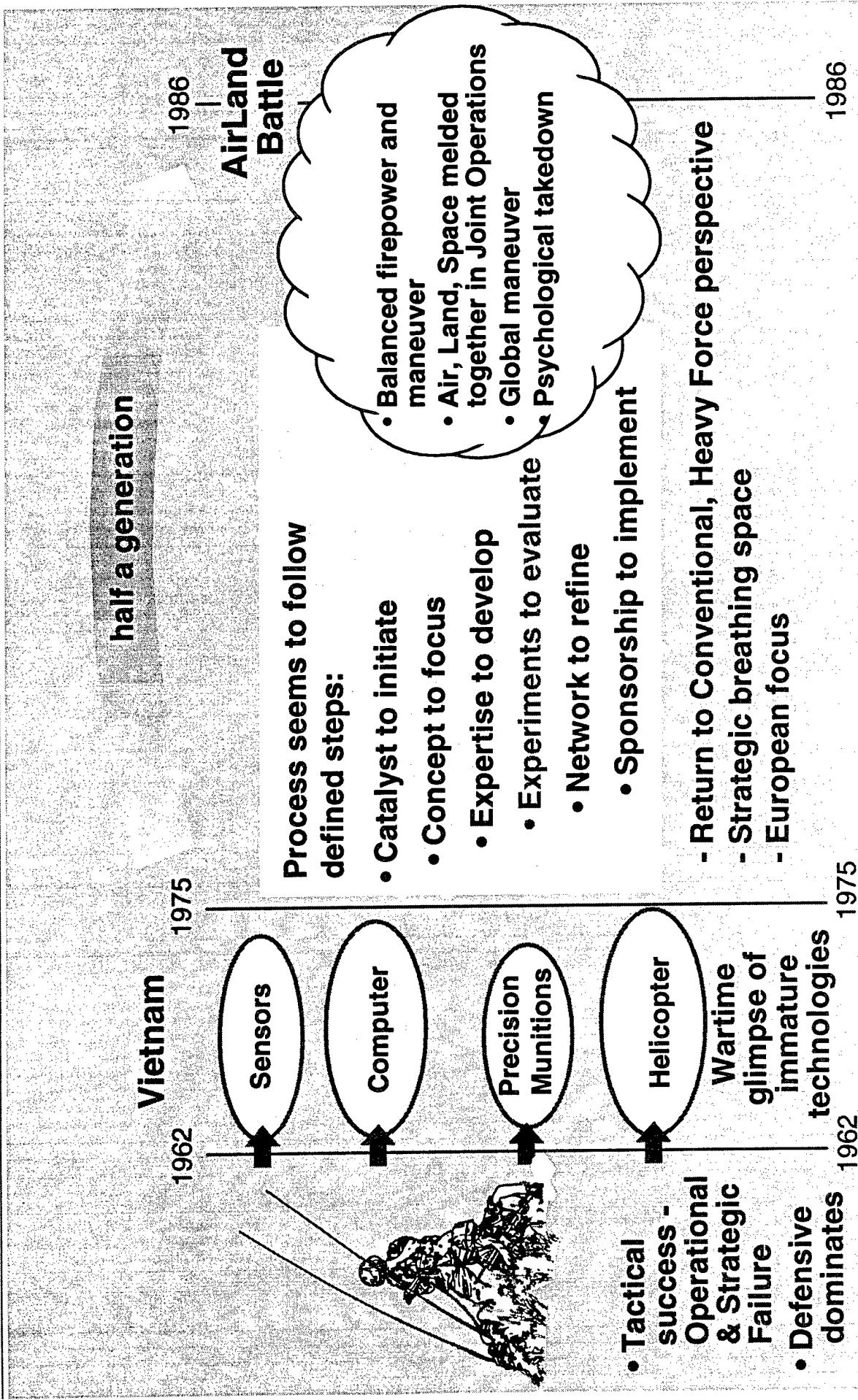
United States Naval Aviation



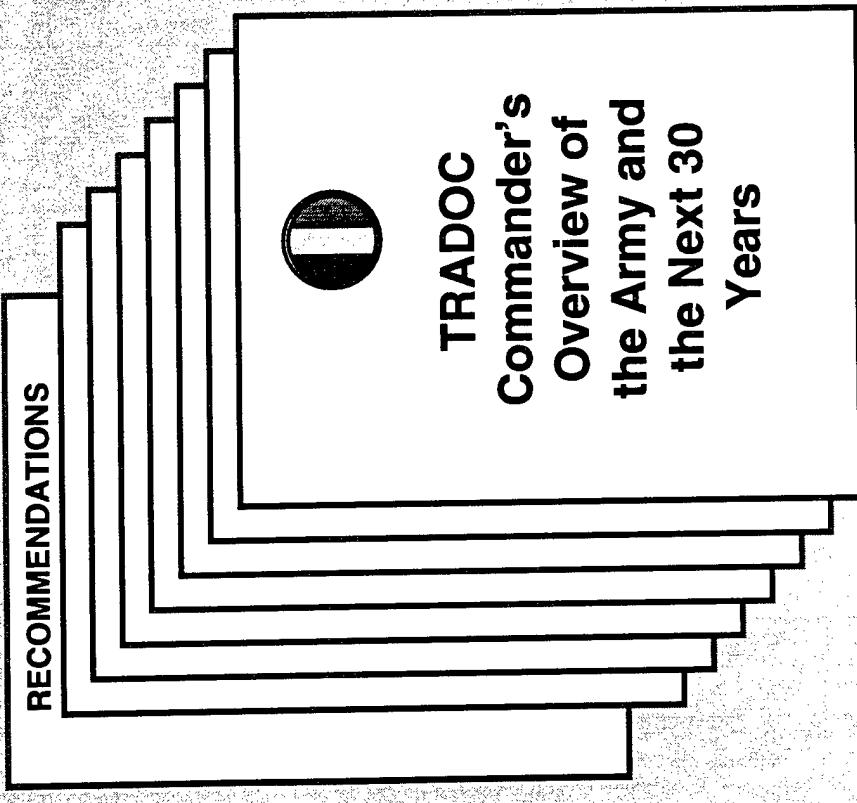


OUR ARMY HAS ALSO BEEN DOWN THIS PATH BEFORE

United States . . . AirLand Battle



TRADOC Commander Annual Paper to CSA



- TRADOC Commander to CSA
- Overview
 - Process of change
 - Geostrategic views
 - Military Art & Science
 - Soldiers and Units
 - Technology
- Recommendations to CSA
- References/Methology

1996-97 AAN Project Activities

- **Created a functional futures network both inside and outside the Army**
- **Hosted 16 conferences and workshops to generate ideas about future warfighting**
- **Tactical Wargames (Oct-Nov 96)**
 - Fed Winter Wargame
 - All-Service participation
- **Winter Wargame (Jan-Feb 97) with excursions**
 - Strategic/operational warfighting circa 2025
 - Interagency/All-Service (over 400 participants)
 - Complex, scenario-driven, computer-supported, free play

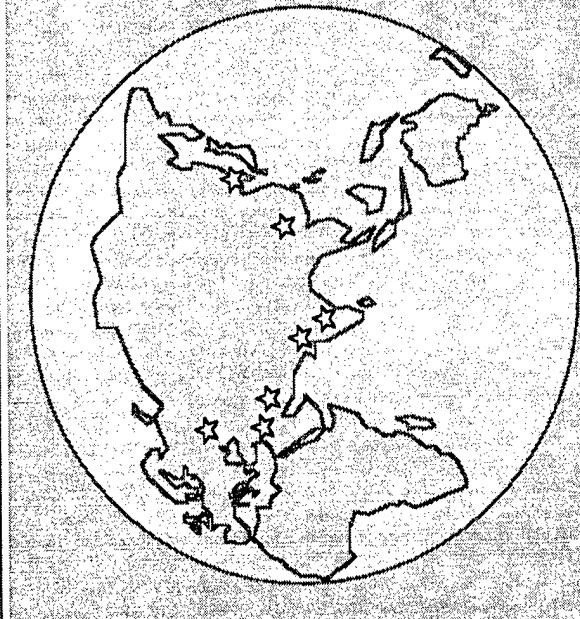


AAN FUTURES RESEARCH FOCUSES INITIALLY ON FOUR AREAS CIRCA 2025:

- Probable geopolitical realities: Ensure stability across the spectrum
- Evolving military art: Balance Precision Engagement and Dominant Maneuver
- Technology: Speed to exploit Information Dominance
- Human and organizational behavior: Mature, cohesive force operating to exploit human cognition



SEVEN YEARS into the 21st CENTURY WE SEE a RISING PATTERN of ASYMMETRY



Among our potential foes there's a common, almost spontaneous movement to posture themselves for asymmetric competition

- Streamlining current forces
- Education/professionalization
- Regional focus on local hegemony
- Shifting operational concepts – deflect air and sea power to preserve standing armies

Asymmetric Investments

Army	Missiles (Ballistic and Cruise)	Air Defense	Submarines	C ⁴ /IW	WMD	Fighters	Missile Ships
India	980,000	1	1	1	1	1	1
North Korea	1,000,000	1	1	1	1	1	1
Pakistan	520,000	1	1	1	1	1	1
Iran	345,000	1	1	1	1	1	1
Iraq	350,000	1	1	1	1	1	1
Russia	670,000	1	1	1	1	1	1
China	2,200,000	1	1	1	1	1	1

Legend:

- Missiles (Ballistic and Cruise)
- Air Defense
- Submarines
- C⁴/IW
- WMD
- Fighters
- Missile Ships



AAN Anticipates the Rise of One or More Major Competitors by 2025

A Major Competitor: Will Not

Not a Peer
(US Look-Alike)
Competitor

- Try to recreate a Cold War bipolar world
- Attempt to match US system-for-system

Will

- Focus on landpower
- Apply limited resources asymmetrically
- Frustrate US with just enough precision to kill and buy time
- Capitalize on intrinsic potential of mass, Popular Will, and inherent strength of the defensive

Stalemate Works to the Advantage
of the Competition



PROBABLE LONG-TERM U.S. STRATEGY (to 2025)

- **Security policy will center on:**

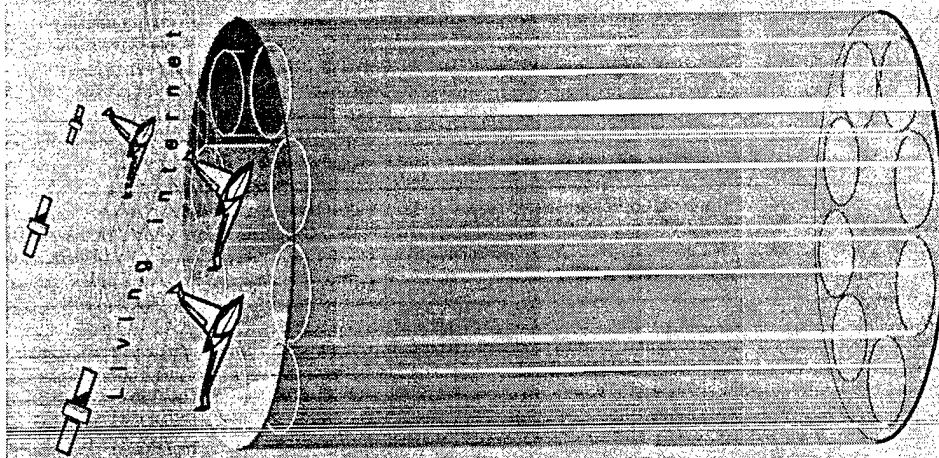
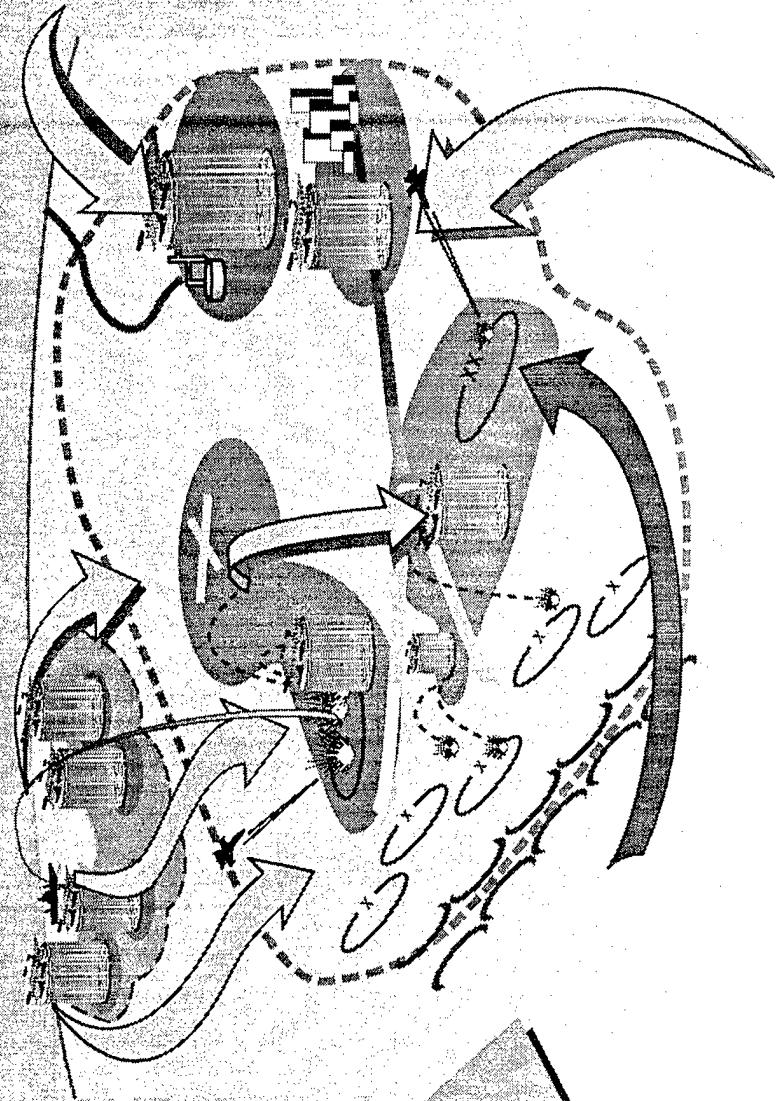
- Security of the United States
- Stability overseas in areas of vital national interest
 - Democracy, economic vitality facilitated by physical, long term presence

- **Military strategy will center on:**

- Defense of United States; land, sea, air, and space in Joint Operations
- Forward engagement (*stationing*) in vital regions
 - Projectable military power

- **Engagement & enlargement will continue worldwide across the full spectrum of operations**

**TACTICAL
WARGAMES**
15 Oct-8 Nov 96



SIMULATING THE FUTURE: A DAUNTING CHALLENGE



CHALLENGE

Effective simulation of both the tangible and intangible aspects of Future Warfare across the Operational Spectrum

Future Warfare Models

Focus: Dominant Maneuver
Precision Engagement
Full Dimensional Protection
Focused Logistics
Dynamic: Information Dominance

Complex
Concurrent
Continuous
Layered

Cold – War Models

Focus: Maneuver and Firepower
Dynamic: Attrition

Making progress -- developing a confederation of complementary Service Wargames:

- Global
- Winter Wargame
- Strategic Force

INFORMATION DOMINANCE TIERS: a METERING DEVICE to ASSESS INTANGIBLES AFFECTING PATTERNS of OPERATIONS



Blue Commander's Perspective

Tier 1:

"I have limited knowledge of the enemy plan and intent, but am able to achieve local information dominance for a limited period of time. This allows me to exploit certain windows of opportunity."

Tier 2:

"I can understand certain components of the enemy plan, recognize his intentions at key decision points and can react to take advantage of those decisions."

Tier 3:

"I see the enemy organizational whole: his pattern of operations, task organization, phasing and tempo. I understand his intent and am able to develop and execute a plan that perfectly counters what he intends to do."



ORGANIZATION for LEAVENWORTH TACTICAL GAMES

White Cell

Mr. Bird, COL Starry, COL Kirin

Blue Cell

BG (ret) Wass de Czege,
TRADOC DCSDOC,
AVN School,
TRADOC DCSINT,
TRAC AF LNO,
JFK SWC

Support Cell

TRAC

Red Cell

LTC House,
TRADOC DCSDOC,
TRADOC DCSINT,
TRADOC BLITCD

Marine Corps Cell*

Advisors
ARL, SAIC, NRO

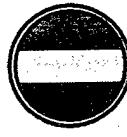
Gamers
TRAC

Observers, Facilitators
TRAC, USAF*, USN*

Other Observers: RAND, CRC, BAH, LIWA, CASCOM,
WWG Ground Component Assessors*

* Phase 3 only

AAN EMERGING IMPRESSIONS from LEAVENWORTH TACTICAL GAMES

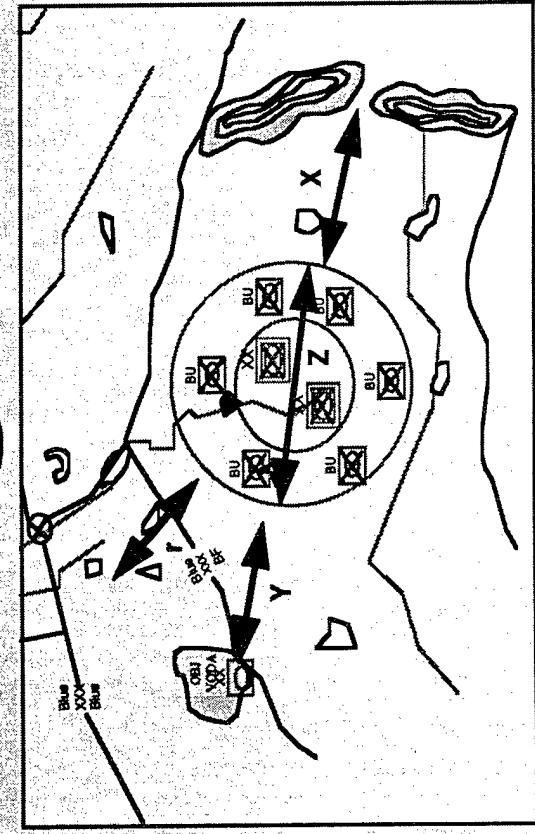


Information Dominance changes the ebb and flow of battle:

- Emboldens Blue
- Raises Red's need for Command and Control -- while simultaneously breaking it

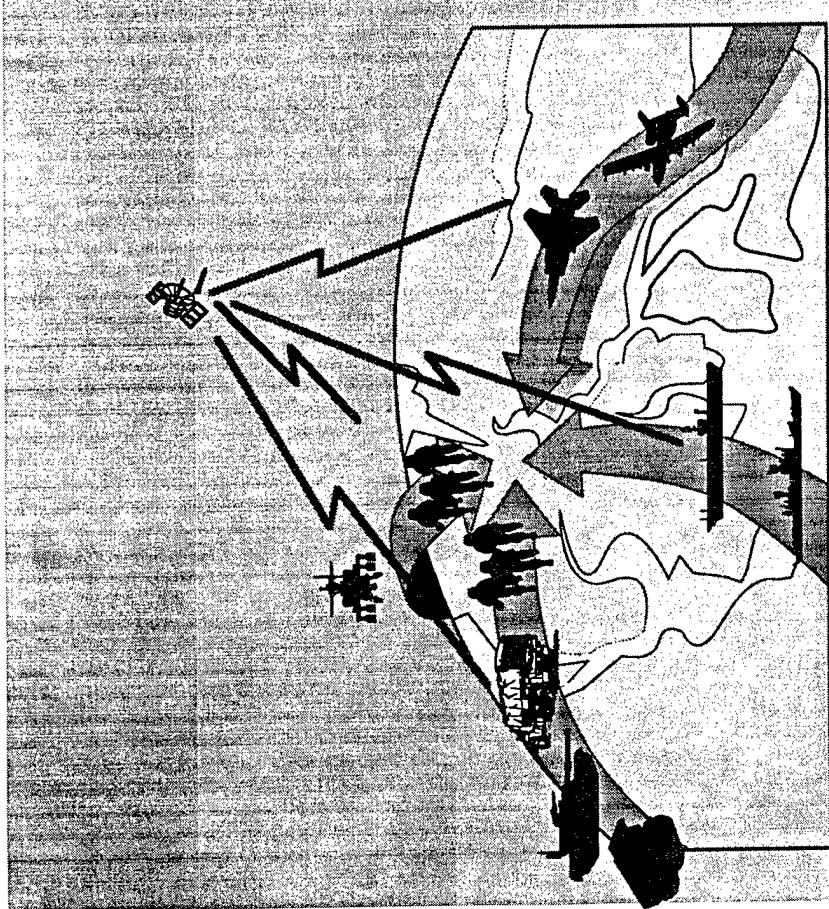
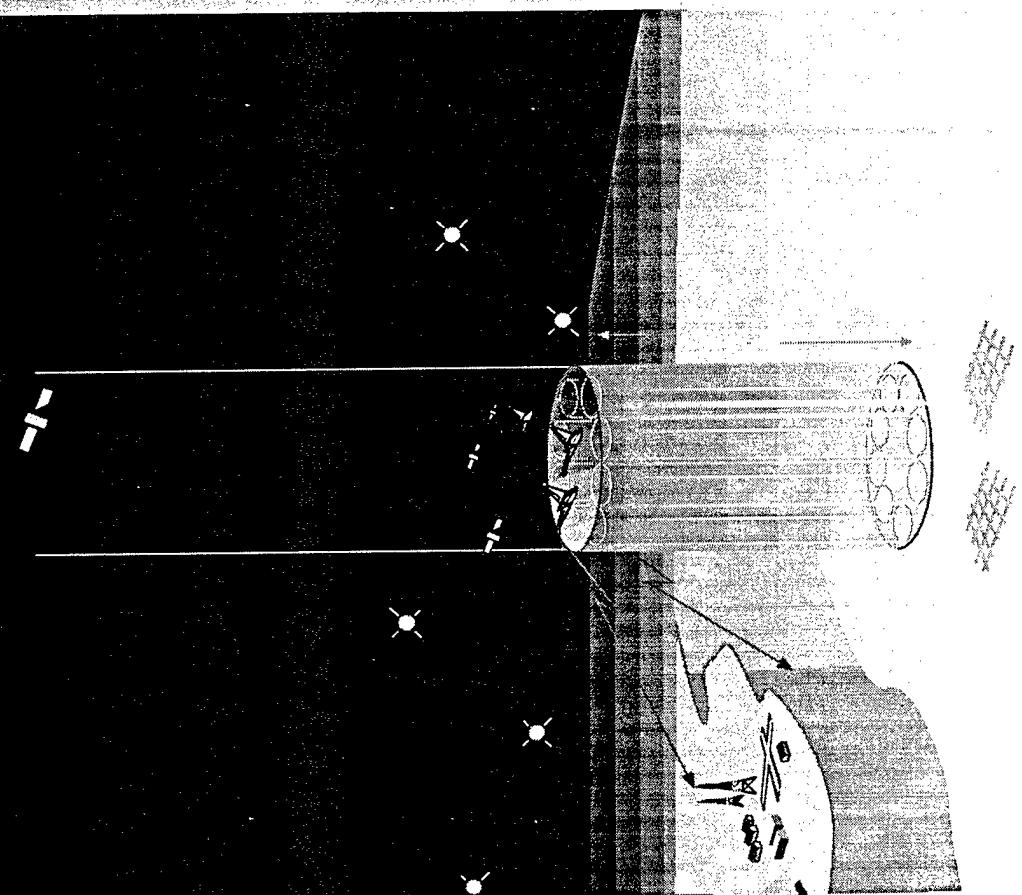
• Dominance of exosphere and space

- Approach by infiltration
- Strike multiple points simultaneously
 - Large-scale tactical air-ground operations
 - Precision Maneuver complements Precision Strike
- Ambush dynamic
- Takedown times: minutes to hours
- Complex landscapes controlled from surrounding areas
- Adds infinite complexity to opponent's situation while collapsing his ability to act



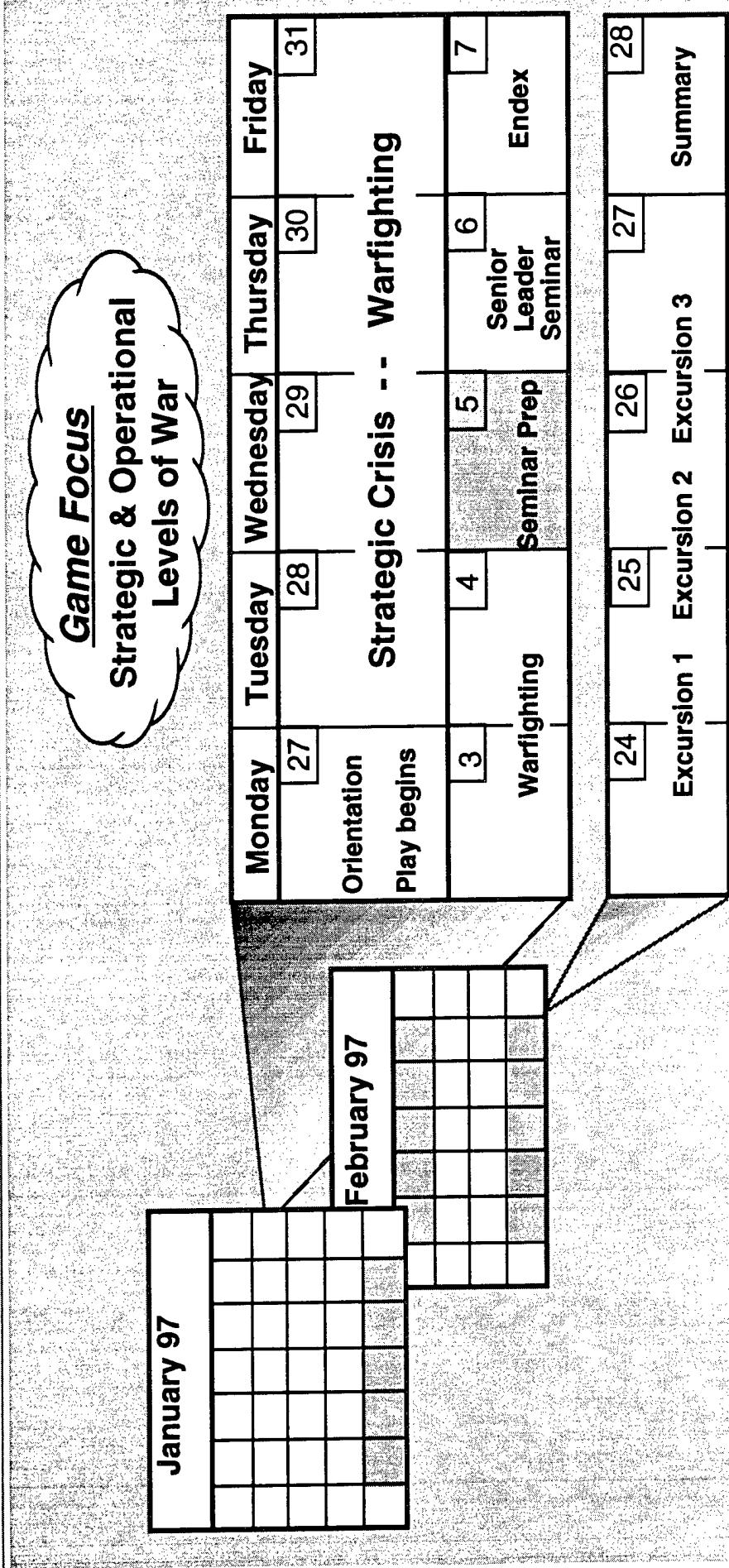
Engage and lose or abstain and concede

**WINTER
WARGAME**
27 Jan - 6 Feb 97





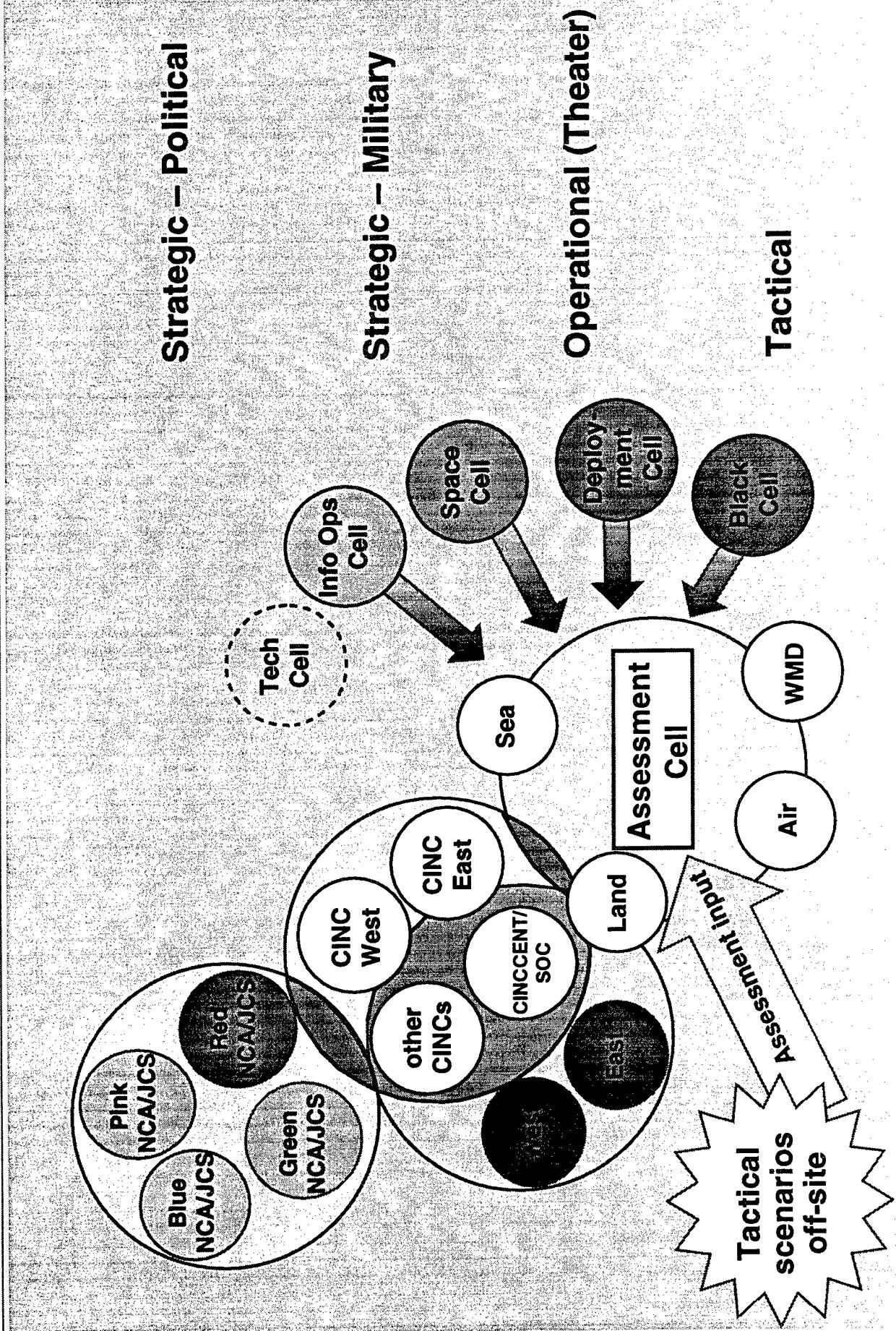
TRADOC COMMANDER'S WINTER WARGAME



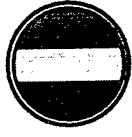
Game Objective

- To provide the Army leadership strategic insights based on operational analysis of war in 2020
- Beyond POM
- Unscripted and free play
- All levels simultaneously
- NCA, interagency, joint and allied play
- Issues, insights, not answers

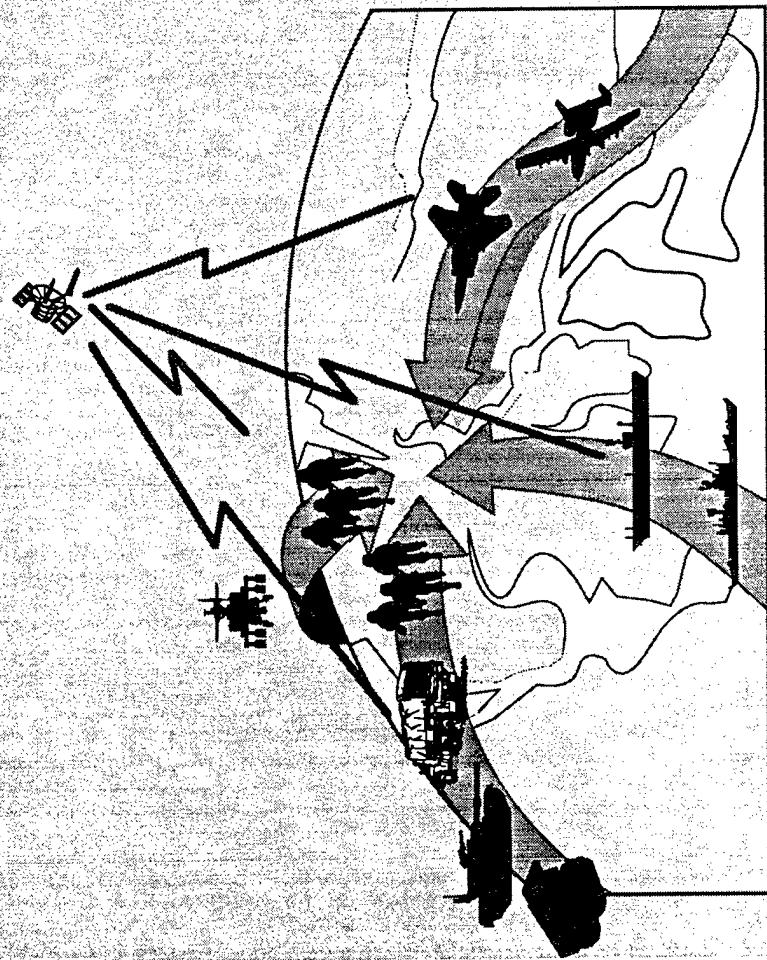
BASIC GAME DESIGN-- THE WORLD IN 2020



AAN WWG EARLY STRATEGIC EMERGING IMPRESSIONS



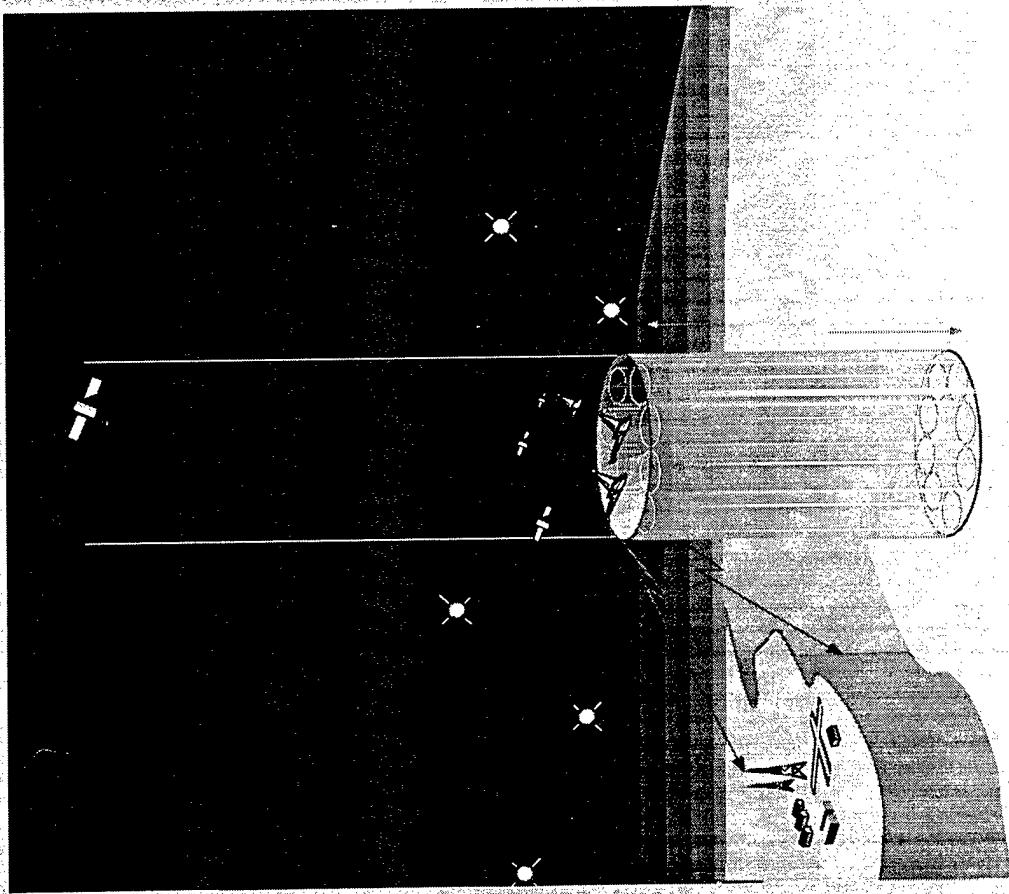
- Military tempo may outstrip pace of diplomatic and political condition setting
- Conflict thresholds more complex and varied
- Overseas presence still counts
- Warfare medium extends continuously from subsurface to space; “jointness” becomes “interdependence”

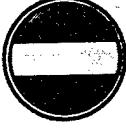


AAN WWG EARLY THEATER/OPERATIONAL EMERGING IMPRESSIONS



- Operational success more dependent upon speed and mobility. Decisions assured within days, if not hours.
- Great synergy in reachout fires and AAN Battle Force partnership
- Think of SOF as global scouts
- “Precision” essential to maneuver, firepower, and logistics

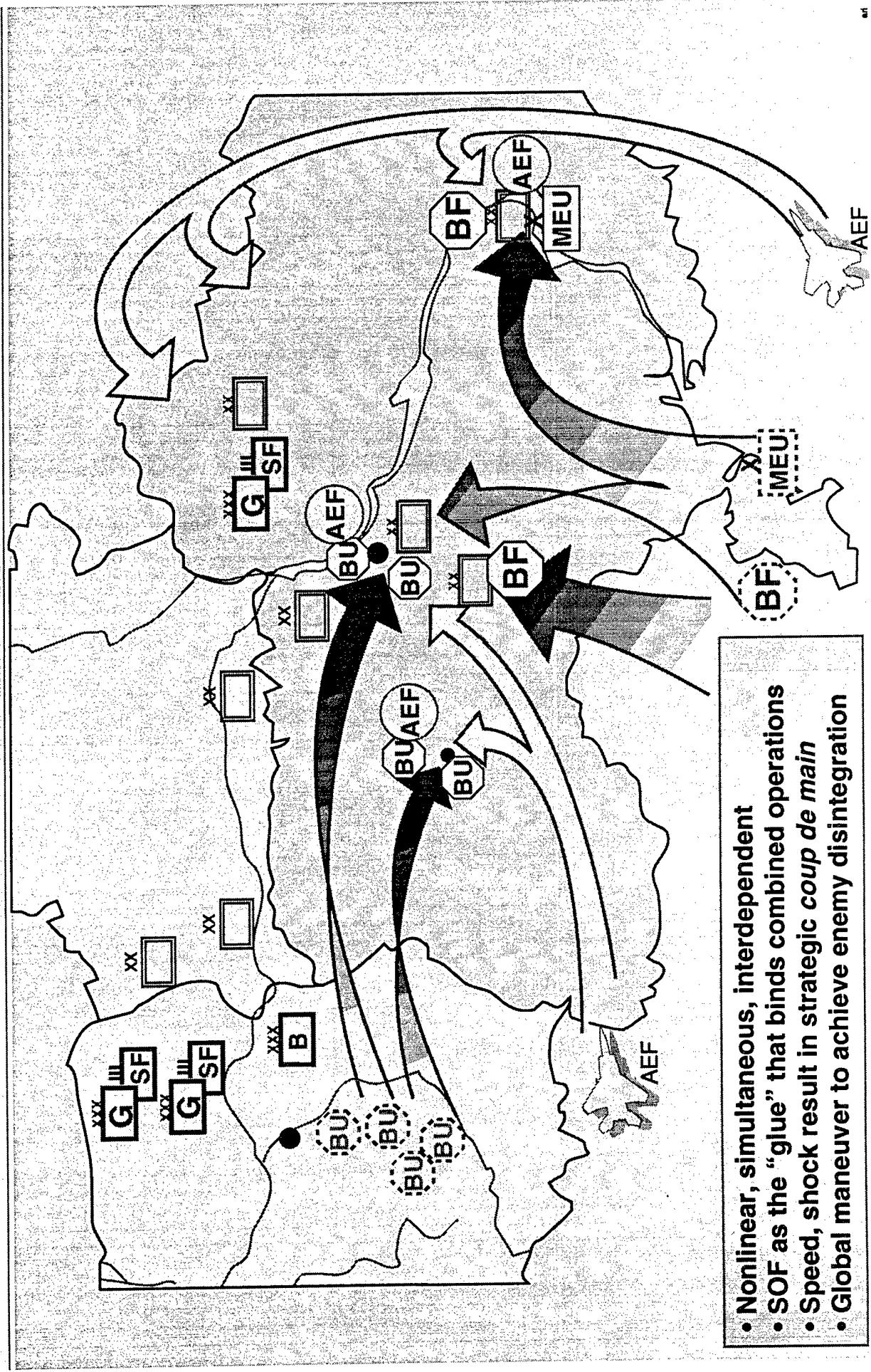




WWG POSTULATED A MILITARY FORCE THAT WILL ACCOMMODATE THE STRATEGIC IMPERATIVES OF 2020

- Global scouts provide global awareness and the “glue” that binds warfighting partners together
- Forward deployed Army XXI Forces: deterrence, immediate response, enablers for force projection
- Preemption Force (AAN-AEF): collapses aggressor before he “sets”
- CONUS Projection Force (Army XXI): force of decision, ensures unrelenting dominance until enemy capitulates

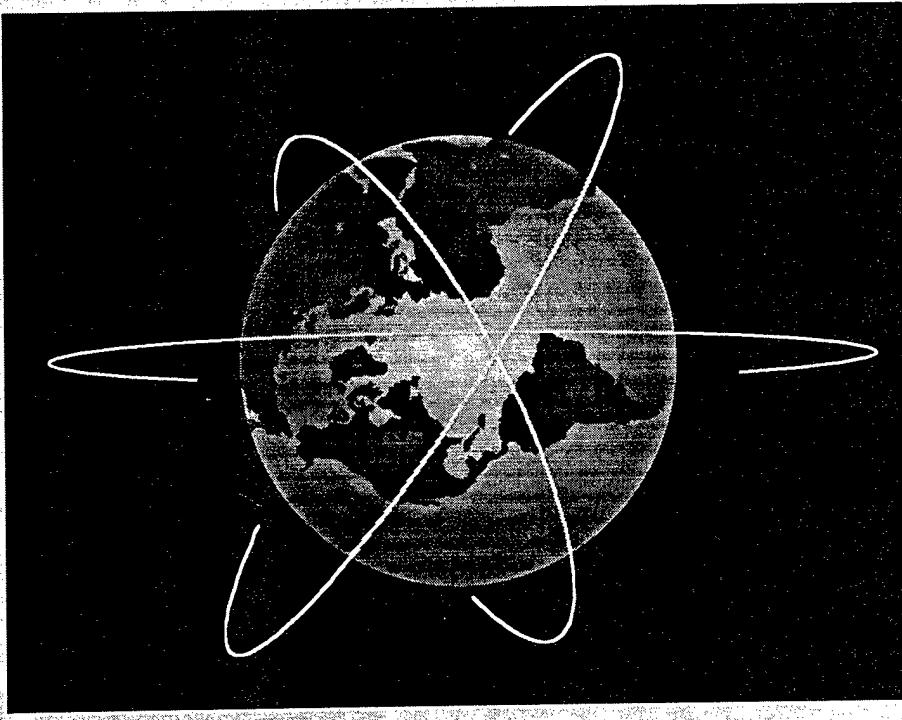
THEATER OPERATIONS CIRCA 2020 WWG GAME TURN 6





AAN WWG EARLY SPACE and INFORMATION EMERGING IMPRESSIONS

- Immediate impact from space attack
- Space-to-ground continuum essential for information dominance
- Information operations contribute directly and immediately to operational and strategic campaigns
- Dependence on GPS demands either a rapid satellite reconstitution capability, a surrogate (UAV) system, or greater redundancies
- Army must broaden its traditional focus on delivery of space products to warfighters





AAN Summer Wargame

- **Objective:** To provide the Army leadership strategic insights based on analysis of a war for “less than vital interests” in 2021
- Partnership -- JFKSWC and AAN
- War will center on Southwest Pacific Basin (Indonesia), regionally based enemy capable of some global (2021) reach
- Smaller in scale than the Winter wargame
- Will add to AAN “history of the future”
- Allied participants: ABCA - France

Summer Wargame Scenario

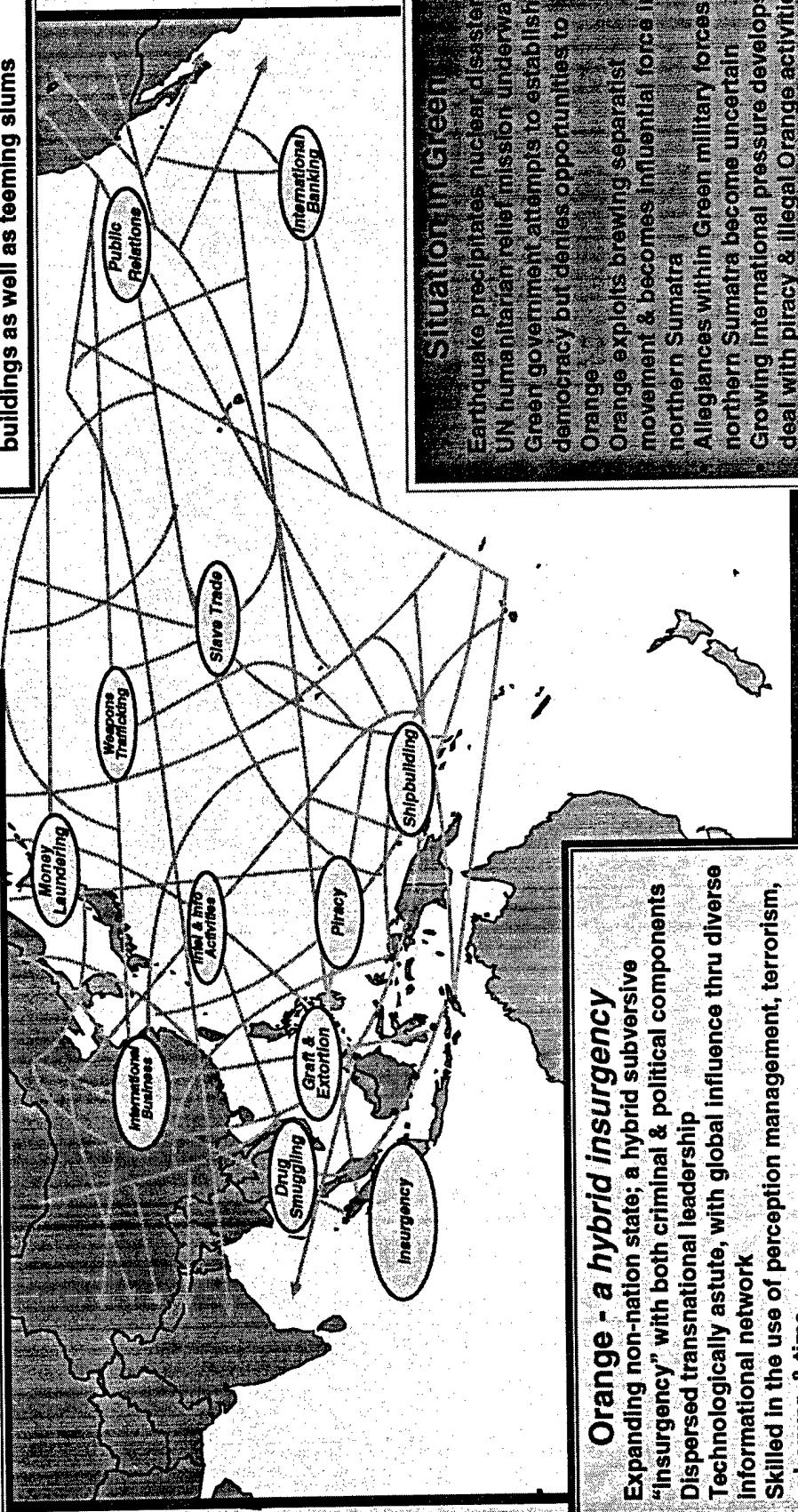


Green Geography

- Archipelago of over 13,500 Islands covers nearly 2M sq km, stretching across three time zones
- Over 3,400 miles from tip to tip
- Mostly equatorial climate
- 55% tropical forest; less than 10% arable land
- Diverse rugged landscape of coastal lowlands and interior highlands
- Many large cities with modern high rise buildings as well as teeming slums

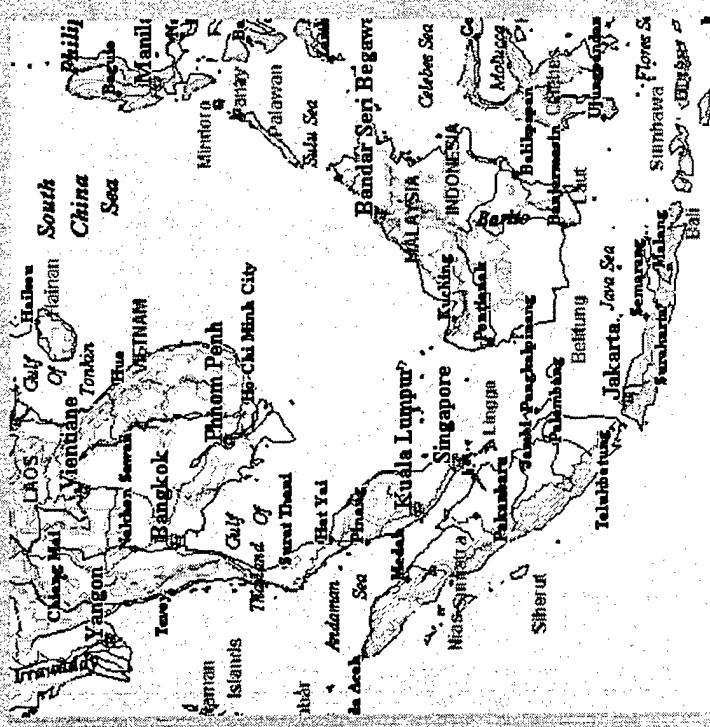
Blue Security Interest in Southwest Pacific

- Fostering political stability, maintaining access to regional markets, and ensuring freedom of navigation
- Preventing the emergence of undue influence by any major competitor or nuclear proliferation
- Protecting U.S. citizens within the region





AAN SWG Strategic Emerging Impressions Concerning Conflicts for Less than Vital Interests



- Web-like network structures characteristic of the dawning information age may obscure and even eliminate centers of gravity

- Conflict may be about controlling time and influence, not about seizing terrain or physically defeating military forces

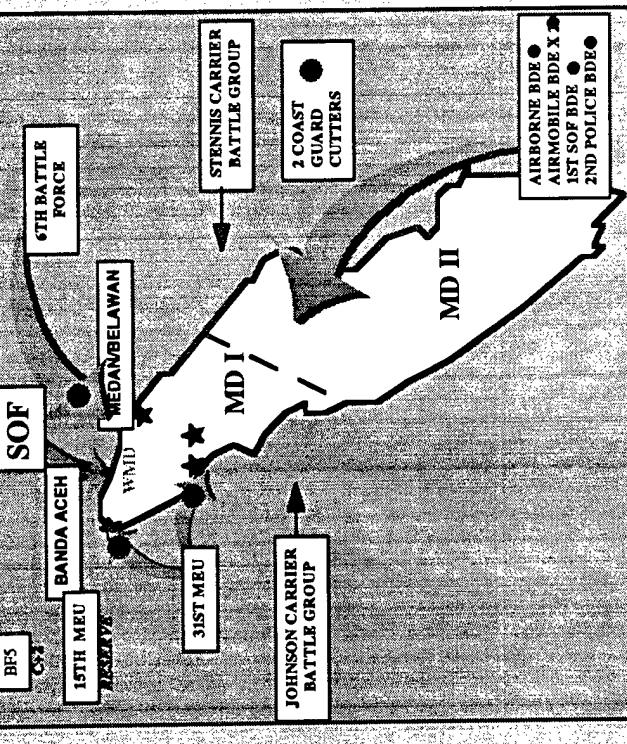
- The presence, in or out of theater, of highly mobile and lethal ground forces appears to cap the level of violence and deter future escalation of conflict

- Effective response requires synchronized application of all elements of national power—the military may play only a supporting role

AAN SWG Theater/Operational Concerning Conflicts for Less than Vital Interests



- Application of military power may be constrained by asymmetric out-of-theater threats (terrorism, info ops, etc.)



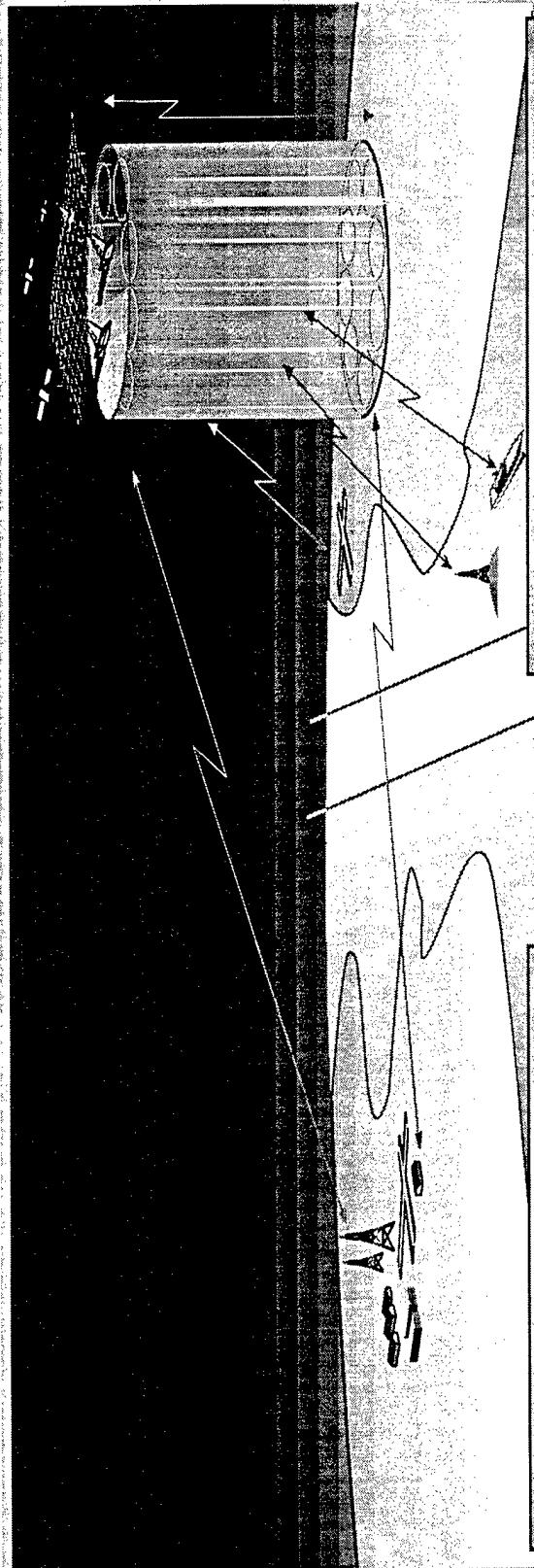
- Discriminatory military operations may have unintended consequences across political and economic domains
- Military power has utility for “shaping the peace”

- Complementary mix of engagement capabilities critical to success:

- Rapid strategic lift
- Highly integrated joint C² and intel systems
- Effective information operations architecture
- Regional expertise linked to operational networks
- Non-lethal systems that empower forces while reducing collateral damage



HUMAN AND ORGANIZATION CHARACTERISTICS OF AAN (2025)



SUPPORT: Focus on Efficiency

Organizational imperatives and processes drawn from civilian/industrial sector

- Flat organizations
- Decentralized management
- Low leader-to-led ratio
- Direct producer-to-user distribution
- Relatively protected
- Individual specialization
- Heavily civilianized/contracted force
- Increased lateral entry

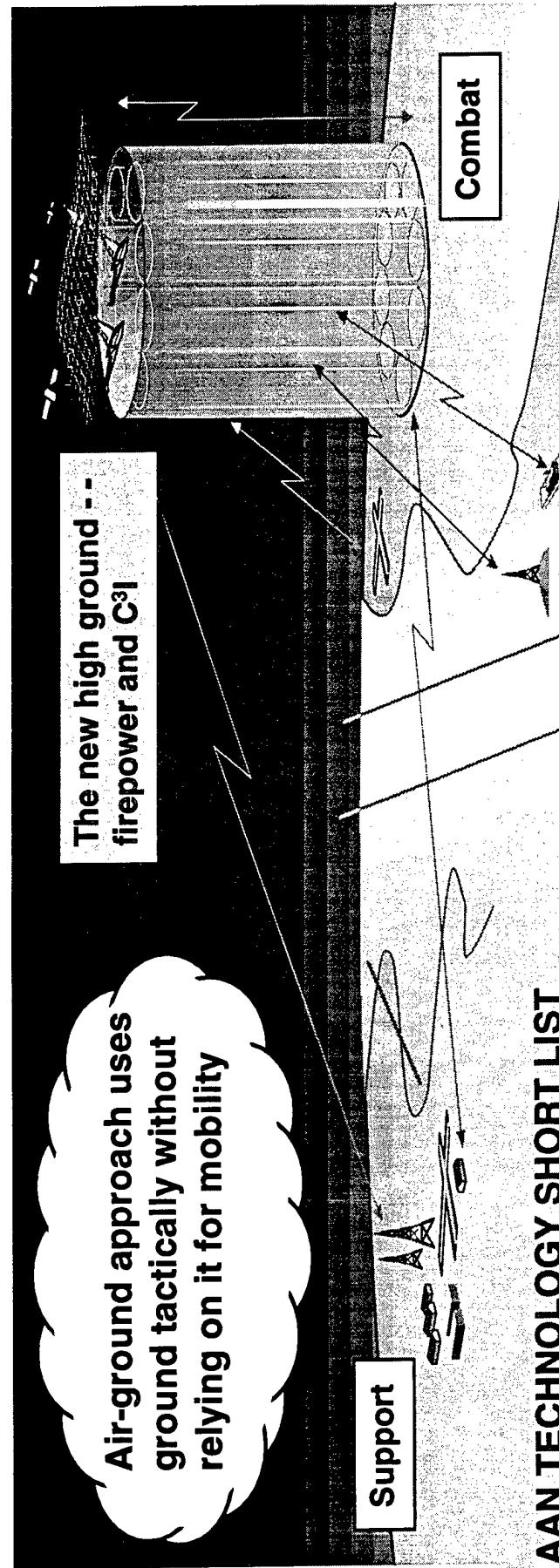
COMBAT: Focus on Effectiveness

Unique military organizations focussed on extreme effectiveness and lethality

- High leader-to-led ratio
- Highly trained, multi-skilled soldiers
- Psychological hardening
- Accent on maturity and cohesion
- Long service, low turnover of personnel
- High tooth-to-tail ratio in deployed forces
- Systems designed to limits of human cognition
- Mastery of information

Requires revolutionary change to traditional
personnel and management approaches

ENABLING AAN: TECHNOLOGIES AND SYSTEMS FOR A BALANCED APPROACH TO WARFARE



AAN TECHNOLOGY SHORT LIST

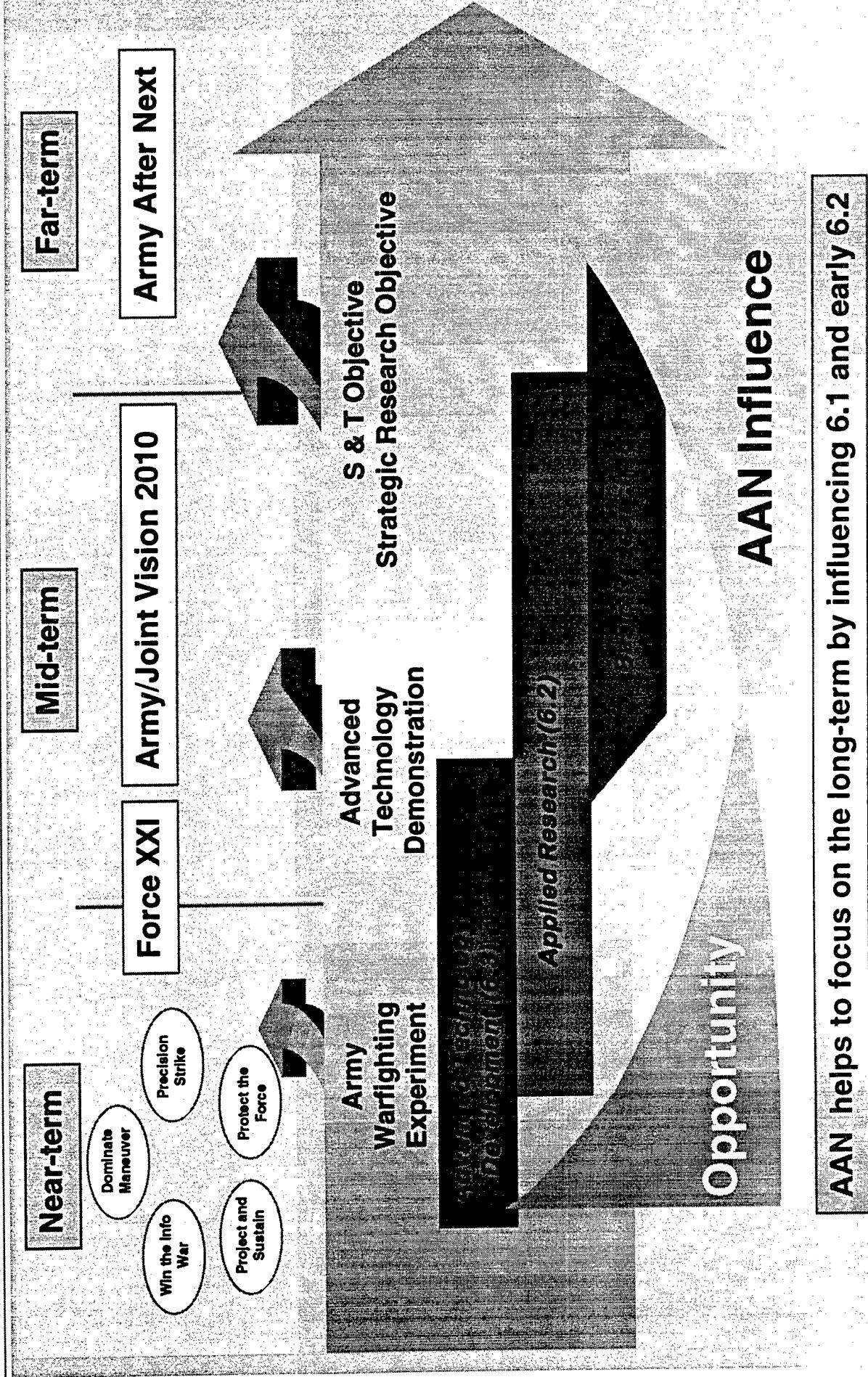
- Hybrid Power Systems
- Fuel Efficiency (Reduce consumption by 75%)
- Human Engineering/Cognitive Engineering
- Signature Control (Including Counters)
- Protection Schemes for Land Systems (Including Active Protection)
- Advanced Materials
- Alternative Propellants
- Biological and Chemical Protection, Antidotes, and Vaccines
- Logistics Efficiencies

AAN SYSTEMS SHORT LIST

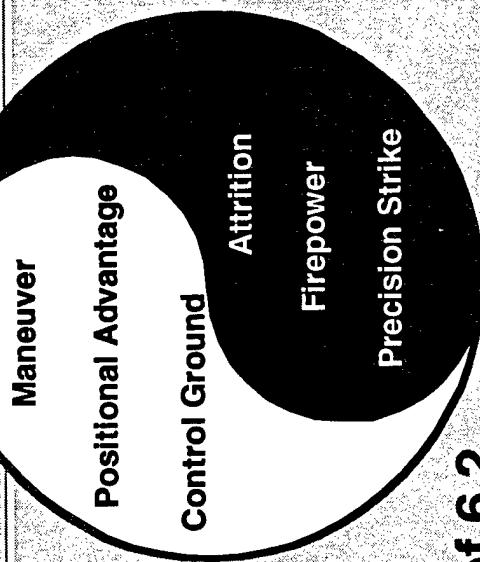
- Future Groundcraft
- Advanced Airframe
 - Heavy Lift
 - Tactical Utility Lift
 - Autonomous and Semi-autonomous
 - Unmanned Systems (Air, Ground, Sensors)
- Advanced Fire Support System
- “Living Internet”



AAN Influence on S&T Investment Strategy



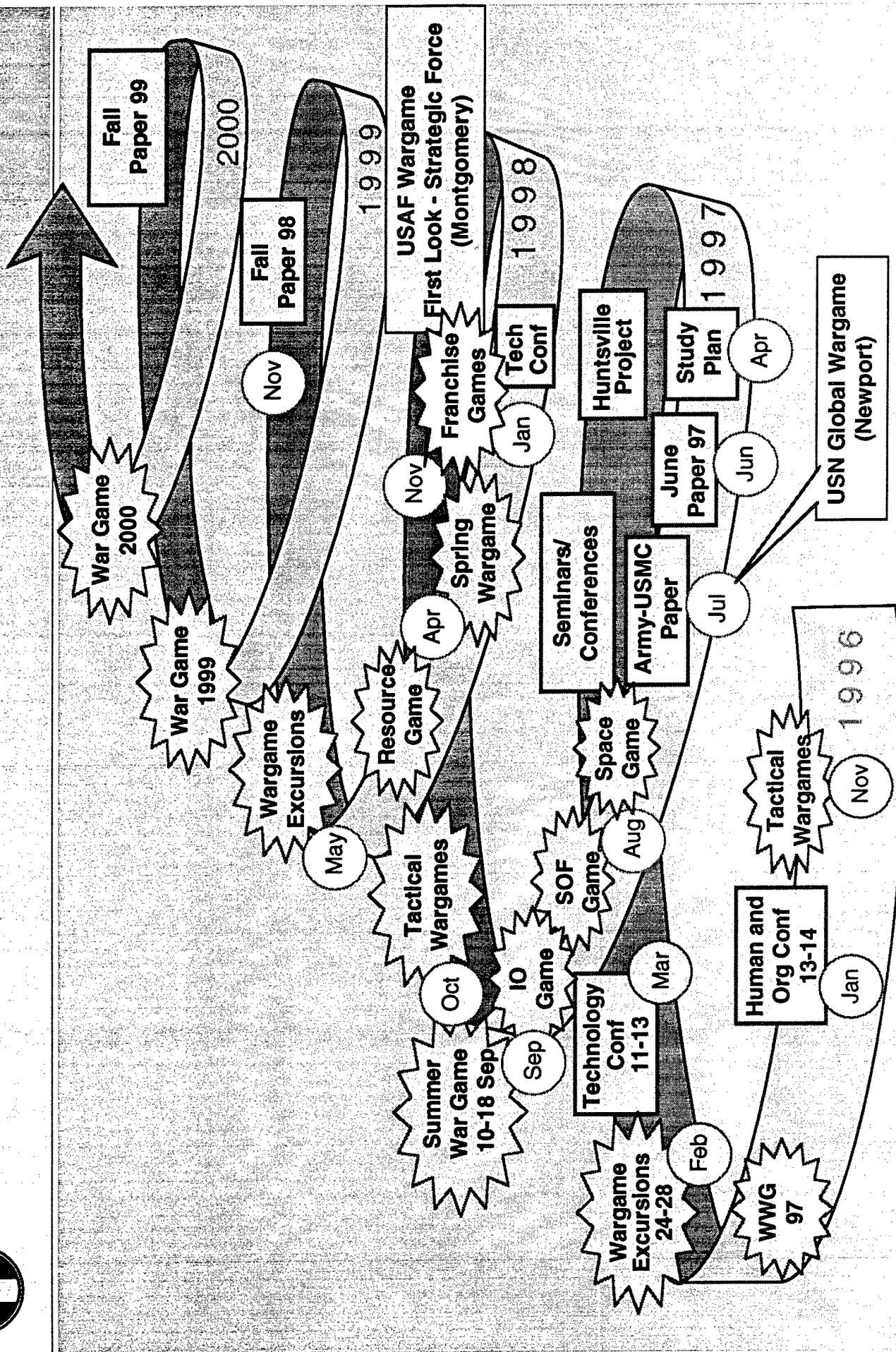
DEVELOPING THE S&T INVESTMENT STRATEGY FOR AAN



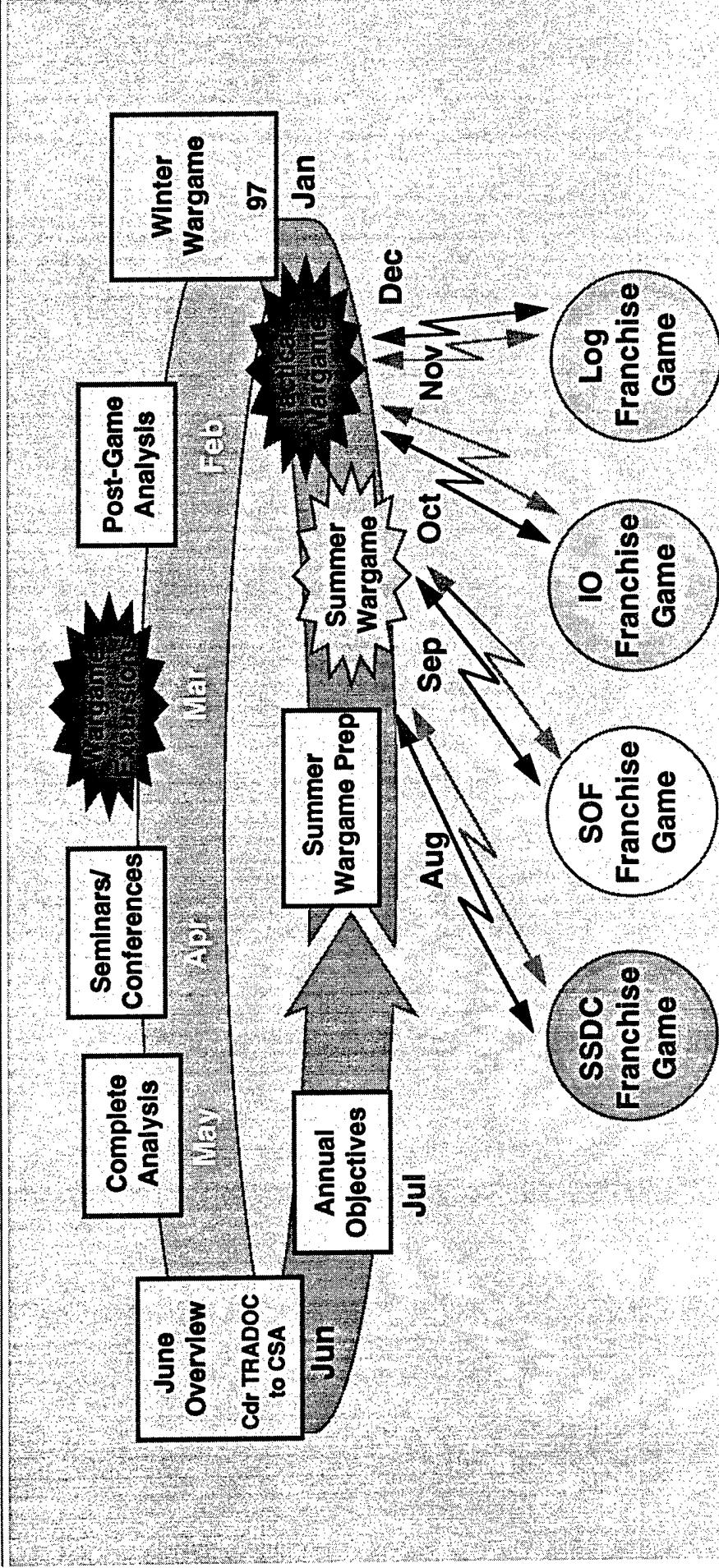
- S&T – AAN partnership established and growing
- Expect to realign 6.1 (~30%) and early part of 6.2 accounts (~15%)
- Developing new Strategic Research Objectives
- Developing Short List of technology thrust for 6.2
 - Areas for Increased Emphasis
- Concentrate on affordable technical approaches

Focus on Army-unique long term challenges

AAN -- THE PROCESS CONTINUES



EXPANDING THE PARTNERSHIP



Franchises are AAN organizations who have agreed to conduct analytical excursions to further develop specific issue areas as feeds to the AAN wargame process.



AAN SPACE GAME (SSDC)

Participating Organizations

- USASSDC
- Army Space Command
- CIA
- DARO
- HQ TRADOC
- Navy Space Command
- Air Staff
- DOD Space Architect
- NRO
- TRADOC TRAC
- USAF Space Warfare Center
- Defense Special Weapons Agency
- JFK Center
- US Army War College
- DUSD (Space)



JFKSWC/SOF GAME (30 Jun-3 Jul 1997)

- Year 2021 South West Pacific – Indonesia
- Insurgency
- Threat to stability in the region threatens US interests
- ARSOF played orange – 3 different orange situations developed
- Participants: ARSOF, other services, NRO, CIA, ASD SOLIC
MG (R) Baratio, MG (R) Shachnow, BG (R) Wass de Czege
- Senior Seminar: LTG Schoomaker, MG Canavan,
MG Tangney, BG Brown, Dr. Quinliven, Dr. Tucker
- Emerging impressions due 9 July

AAN Winter Wargame



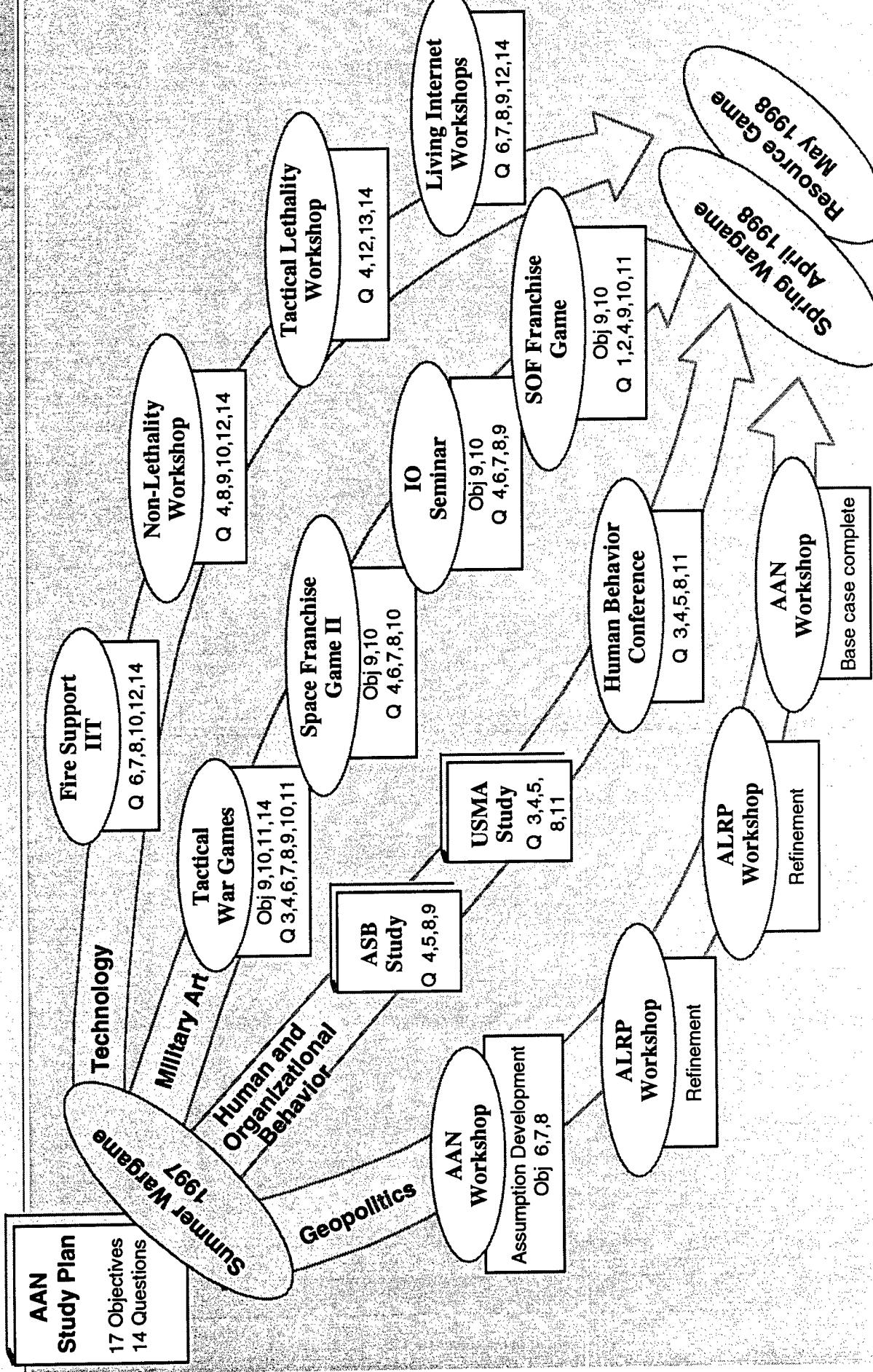
- **Objective:** To provide the Army leadership strategic insights based on analysis of a war for vital interests in 2021
- Political-Military Game
- Similar scenario to first game: Provides iterative analysis with a rich scenario to further develop issues
- Game process improved through lessons learned
- Comprehensive analysis builds on completed work
- Currently scheduled: 26 Jan–6 Feb 1998

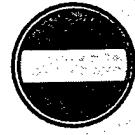
AAN . . . the Next 6 Months



AAN Study Plan
17 Objectives
14 Questions

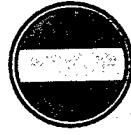
Summer War Game
1997



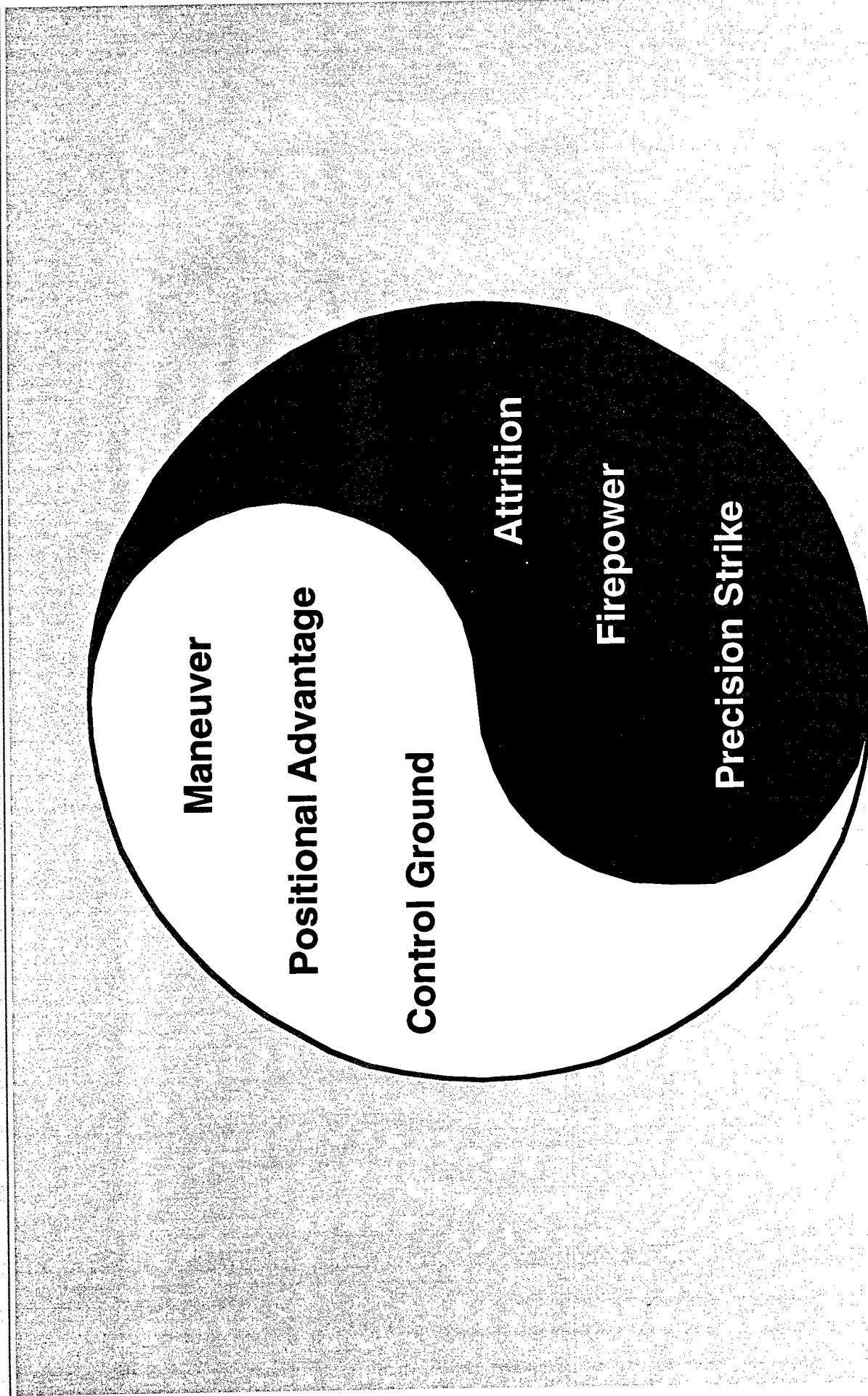


EMERGING POSITIONS

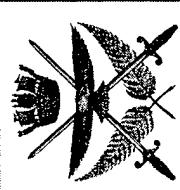
- International system will continue to be geopolitically based
- Probability of state-on-state conflict will continue to justify military forces
- Human and organizational behavior probably dominates technology – but need to work relationships
- *Have to win wars as well as battles*



ART of WAR: a HISTORICAL PERSPECTIVE on the CYCLES and PATTERNS of CHANGE



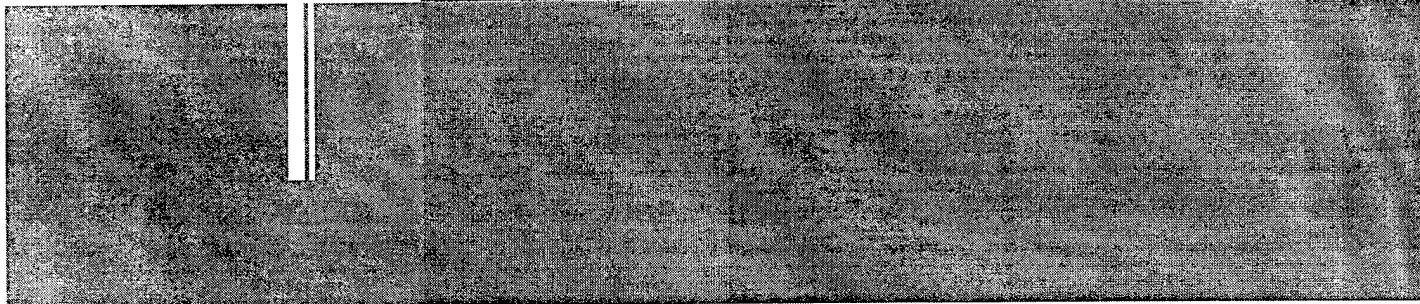
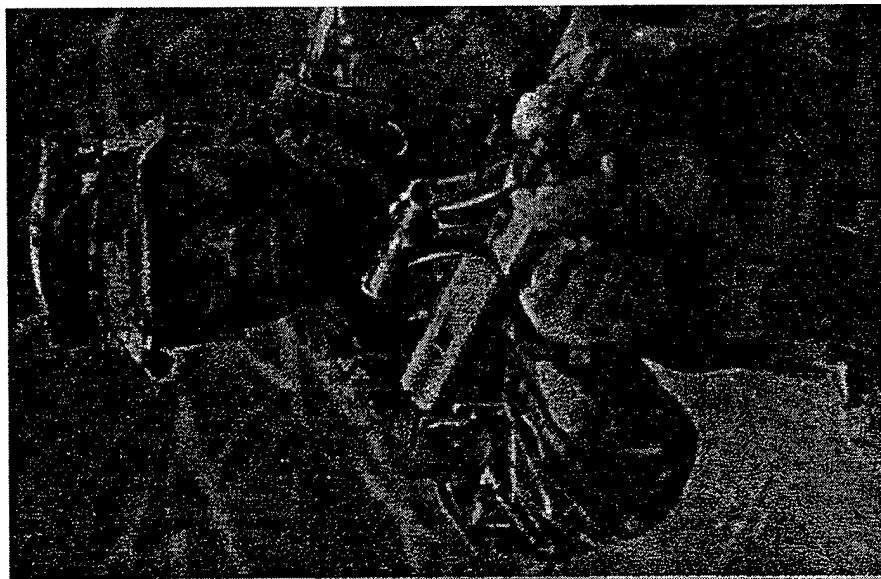
An Ethos-Directed Army for the 21st Century



Dr Clancy Downes
Senior Research Officer
New Zealand Defence Force

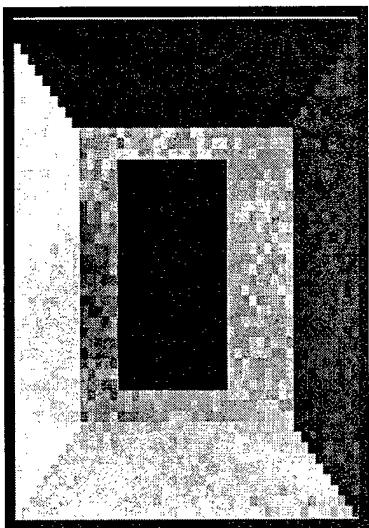
Military Ethos

- ◆ Military Ethos and Military Effectiveness
- ◆ Components of a Military Ethos
- ◆ Challenges for Building an Effective Military Ethos



Components of Military Ethos

- ◆ A purpose with legitimacy in the eyes of followers and the broader society

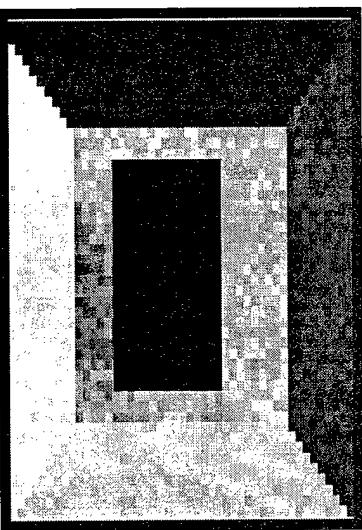


Not just any Cause will do

(Just War Principles)

- Cause must be a just one, motivated by right intentions
- Competent authorities must authorise the use of force
- Sufficiently clear prospect of success to justify human and other costs of war
- Use of force must offer a better situation, if successful than if not used
- Use of force must be proportional to objectives; peaceful means must have failed
- Noncombatants must be accorded immunity
- Means of using force must be moral; evil may not be done that good may come of it

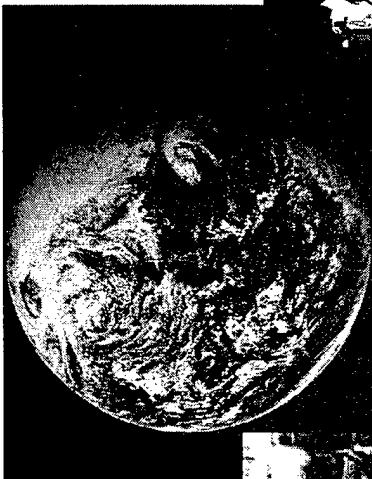
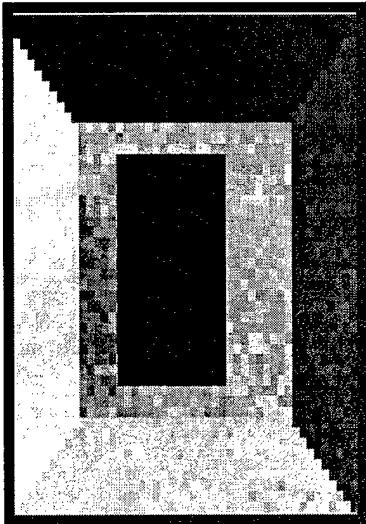
Components of Military Ethos



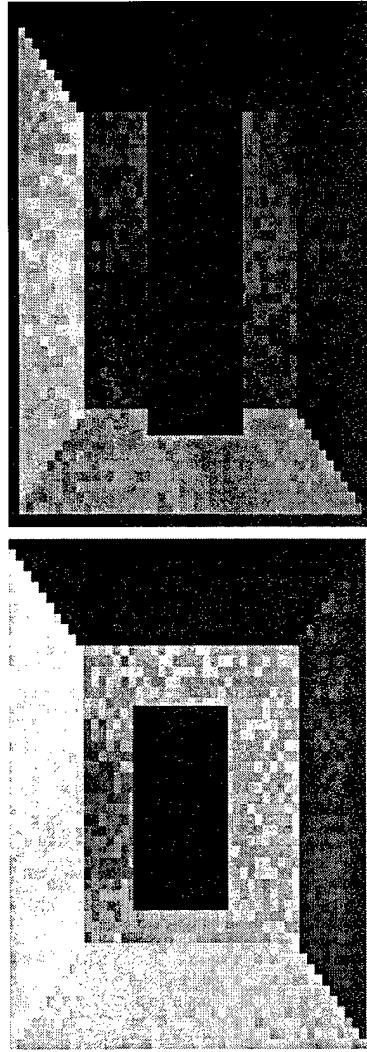
- ◆ A purpose with legitimacy in the eyes of its followers and the broader society
- ◆ A extraordinary purpose - future-focused, with broad benefits for the community

Components of Military Ethos

- ◆ A purpose with legitimacy in the eyes of its followers and the broader society
- ◆ A extraordinary purpose - future-focused, with broad benefits for the community
- ◆ A purpose that cannot be achieved easily or by one person



Components of Military Ethos



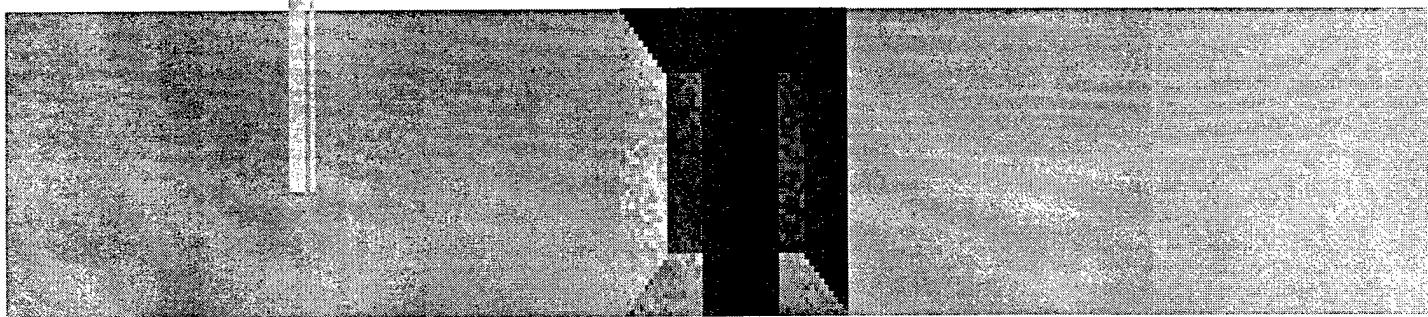
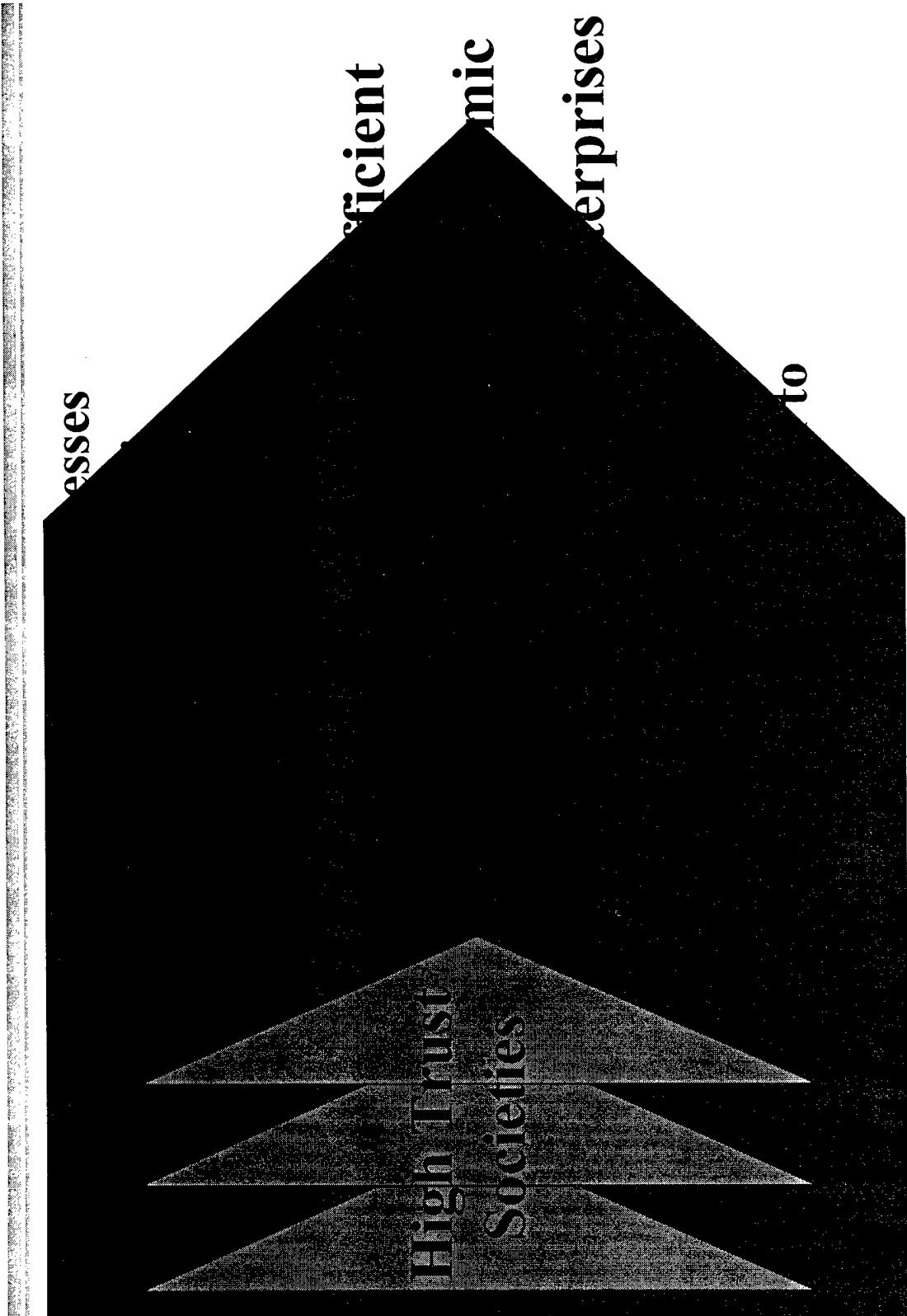
- ◆ “From the Start Line to the End-Line”
- ◆ Source of Trust that underpins Effectiveness

Social Trust - Social Capital

High Trust Societies Low Trust Societies

<ul style="list-style-type: none">■ family, community and government-directed life are in balance■ diverse and many voluntary organisations■ social behaviour based on ethical habits and shared obligations■ over-coming self-interest is motivated by solidarity with community	<ul style="list-style-type: none">■ family and government-directed life predominates■ few voluntary organisations■ social behaviour based on explicit rules and regulations■ over-coming self-interest is directed by the State or the family
--	--

Social Capital and Effective Economies



Social Capital and Effective Militaries

try that: to

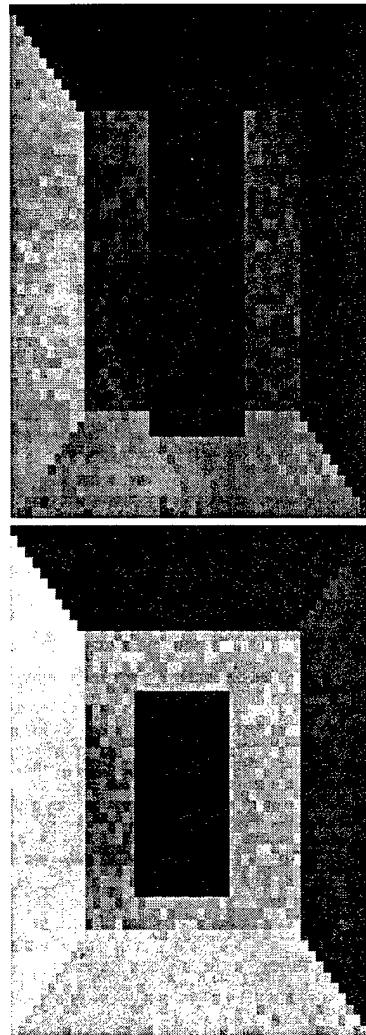
try

A 3D point cloud visualization of a bridge structure, showing a dense grid of points forming the bridge's framework. A small red arrow points towards the center of the bridge's deck.

www.oriental.com

19. *Leucosia* *leucostoma* (Fabricius) *leucostoma* (Fabricius) *leucostoma* (Fabricius)

Components of Military Ethos

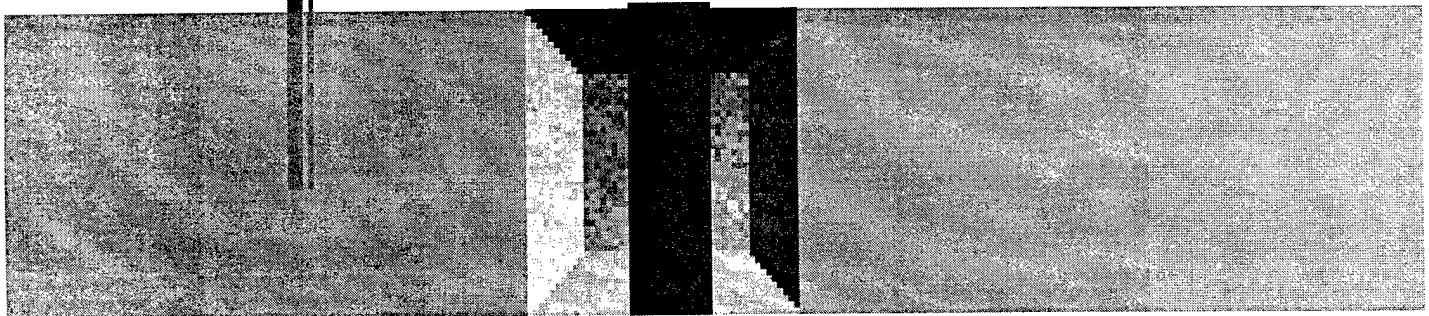


Ethos-Focused Leadership Tasks:

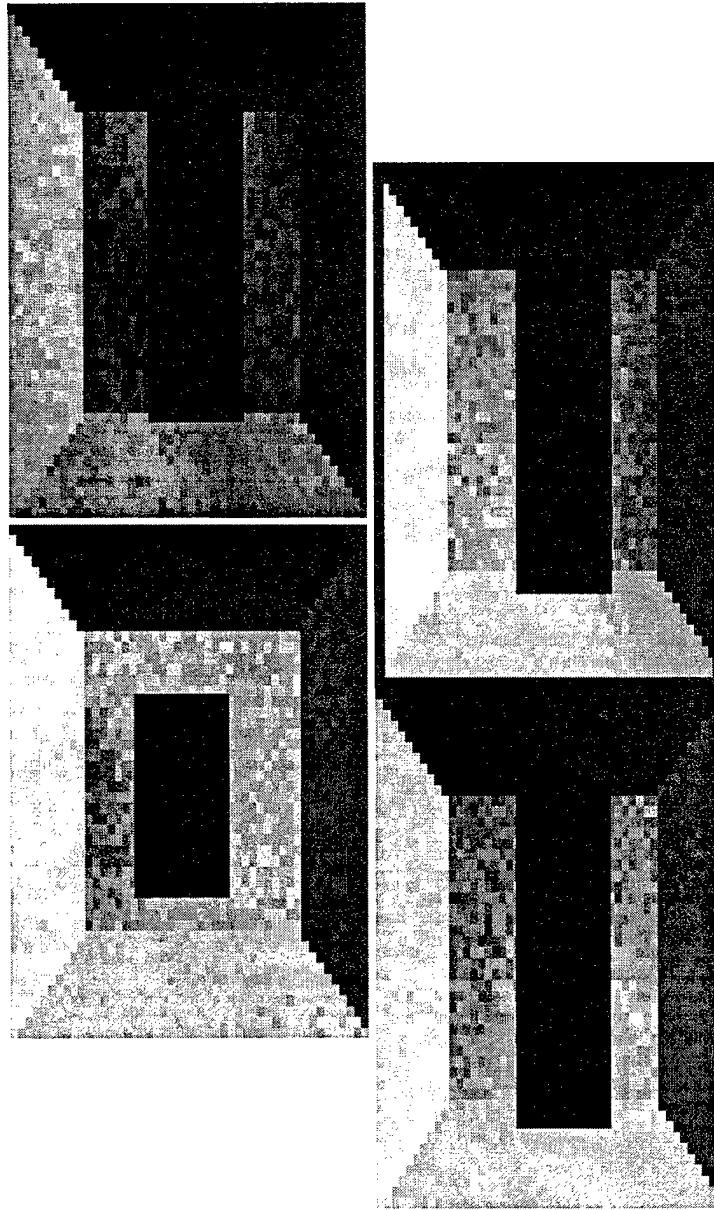
- ◆ Define organisational values and purpose
- ◆ Communicate Standards
- ◆ Make reality match rhetoric

Ethos-Directed Leadership - E³

- ◆ Example, Example, Example
- ◆ concept of Service
- ◆ energy and enthusiasm
- ◆ innovation, ingenuity and inventiveness
- ◆ keen sense of fair-dealing and justice
- ◆ sense of humanity and respect for human diversity
- ◆ good sense of humour and timing



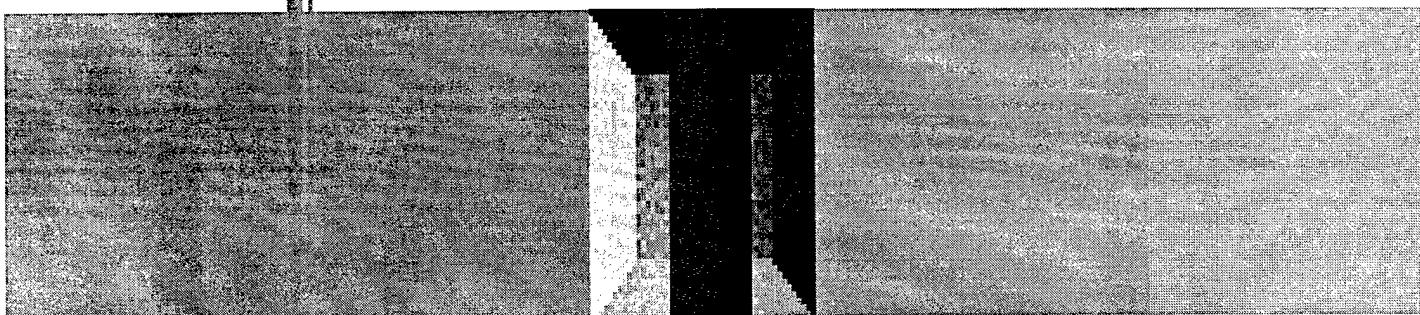
Components of Military Ethos



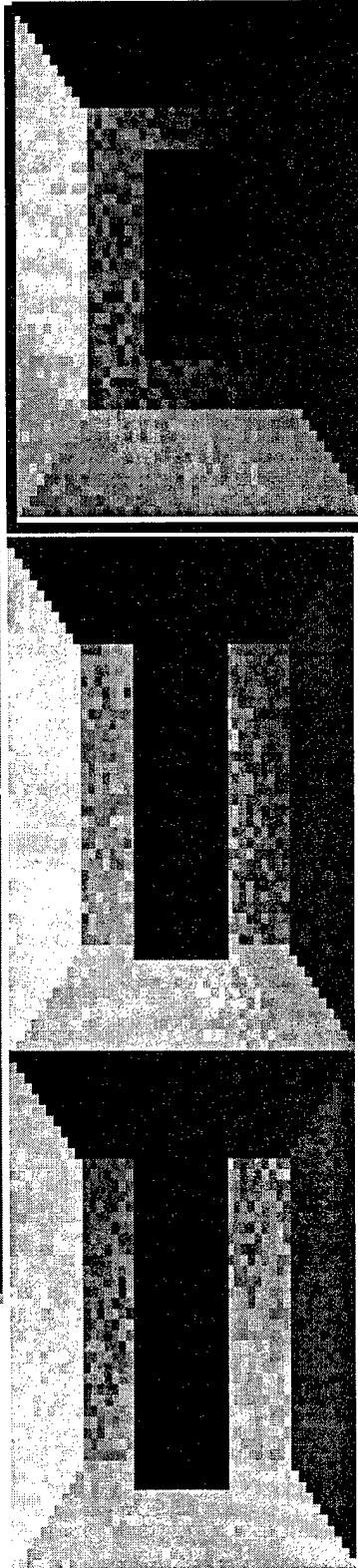
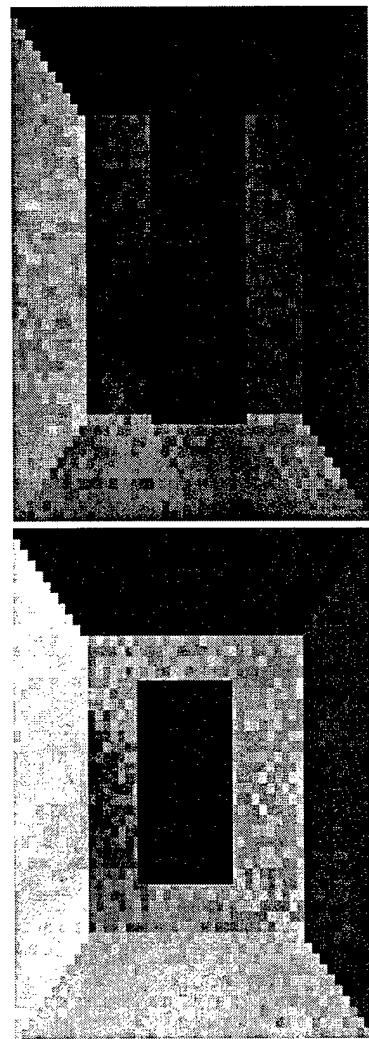
- ◆ the best attributes of Vocation, Calling, Institution and Profession

Qualities of a Military Profession

- ◆ Monopoly of distinctive set of skills, knowledge
- ◆ A system of continuous education and learning
- ◆ Commitment to altruistic service to the extent of unlimited liability
- ◆ Unrestricted service to society as a whole
- ◆ Allegiance and obedience to a lawfully-constituted national authority
- ◆ Self-regulation of membership, and performance standards within bounds of civil oversight
- ◆ Robust sense of professional community



Components of Military Ethos

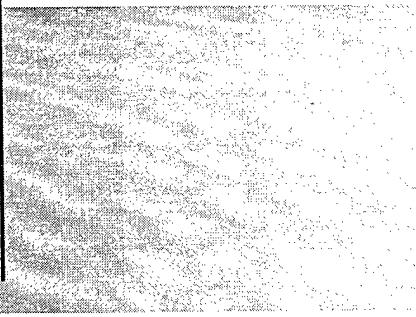
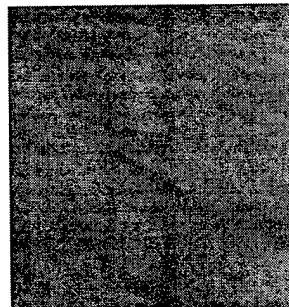


- ◆ the special purpose of an Army
- ◆ price of membership of the military community

Ethics and Values

- ◆ Service to troops, service to nation, ahead of service to self
- ◆ Inviolate special moral trust and responsibility
- ◆ First loyalty to the welfare of those persons for whom an officer is made responsible
- ◆ Share (or exceed) the burden of risk and sacrifice experienced by followers
- ◆ Virtues of honesty, (to self and others) loyalty, and reliability (trustworthiness)
- ◆ Refusal of unethical orders and preparedness to report unethical behaviour

The Body of Military Ethos



Major Sullivan Ballou, to his wife,
14th July 1861, Smithfield, Washington D.C.

...I feel impelled to write a few lines that may fall under your eye when I am no more. I have no misgivings about or lack of confidence in the cause in which I am engaged, and my courage does not falter. I know how American civilisation now leans upon the triumph of the government and how great a debt we owe to those who went before us through the blood and suffering of the revolution. And I am willing, perfectly willing, to lay down all my joys in this life to...pay that debt.

Sarah, my love for you is deathless. It seems to bind me with mighty cables that nothing but Omnipotence can break. And yet my love of country comes over me like a strong wind and bears me irresistably to the battlefield...

...Maj. Ballou was killed a week later at the First Battle of Bull Run

The Military Ethos of an Effective Army

Cause

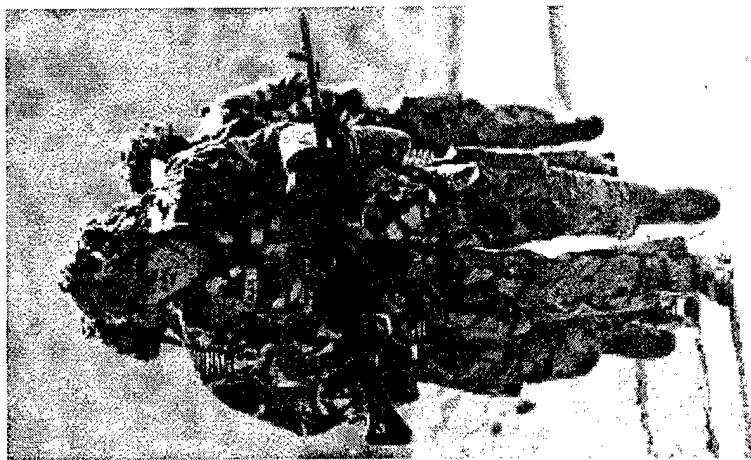
An effective battalion implies a state of mind - I am not sure it is not a state of grace. It implies a giving and a taking, a sharing of almost everything - possessions, comfort, affection, trust, confidence, interest. It implies a certain

Community

Leadership

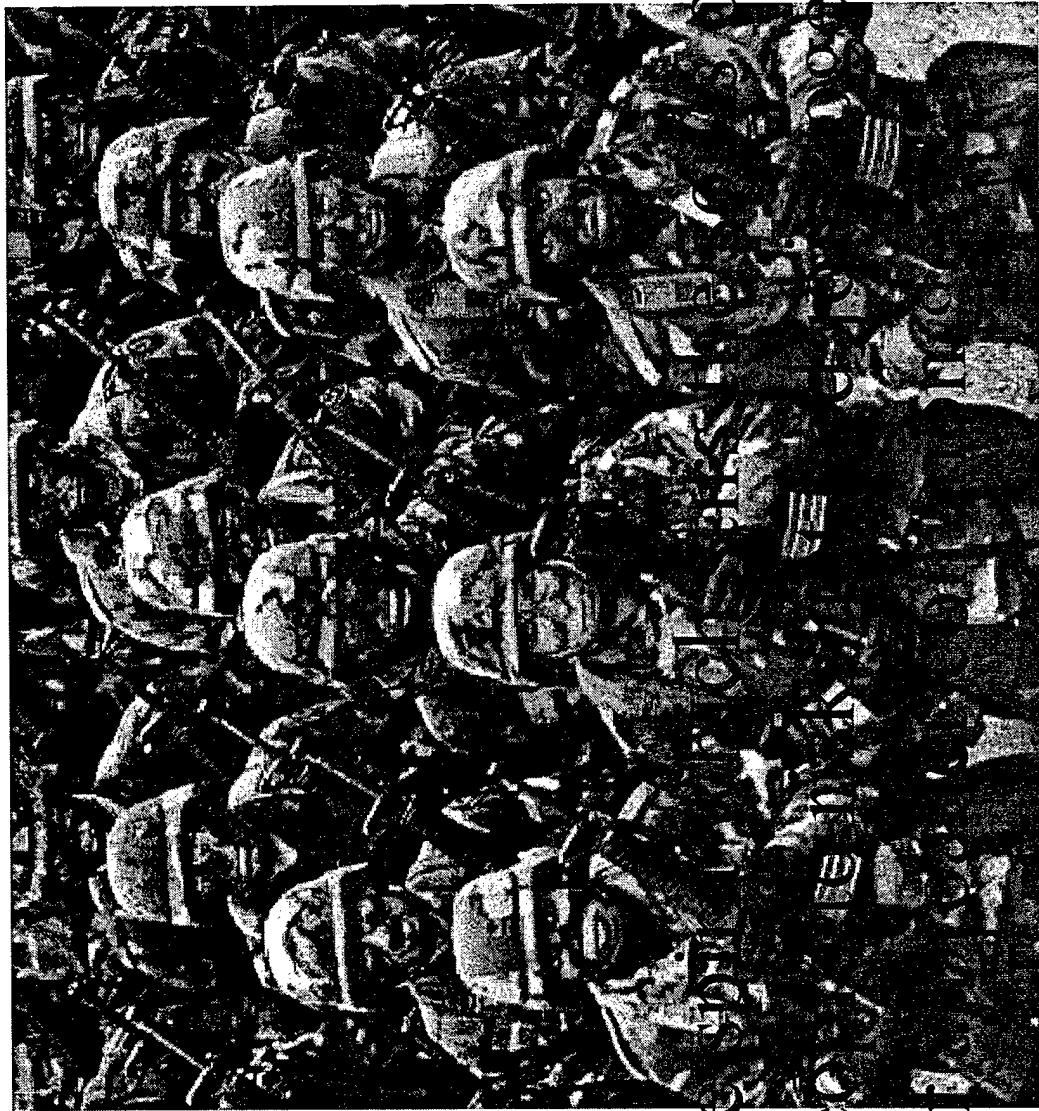
Profession

Ethics



H. Gullett, 'D' Company, 2/6th Battalion, 2nd Australian Imperial Force,
Not as a Duty Only - An Infantryman's War

Military Ethos is.....



Cause

Community

Leadership

Professional

Ethics

Millennium Warrior and the Unknown Fixture

The Challenges of

Building a Military Ethos

- ◆ When is the next fixture?
- ◆ Who are the other players?
- ◆ Which ground we will be playing on?
- ◆ Which set of rules will be followed?
- ◆ Who defines victory and what is it?
- ◆ How do we build-up our training to peak at just the right time?

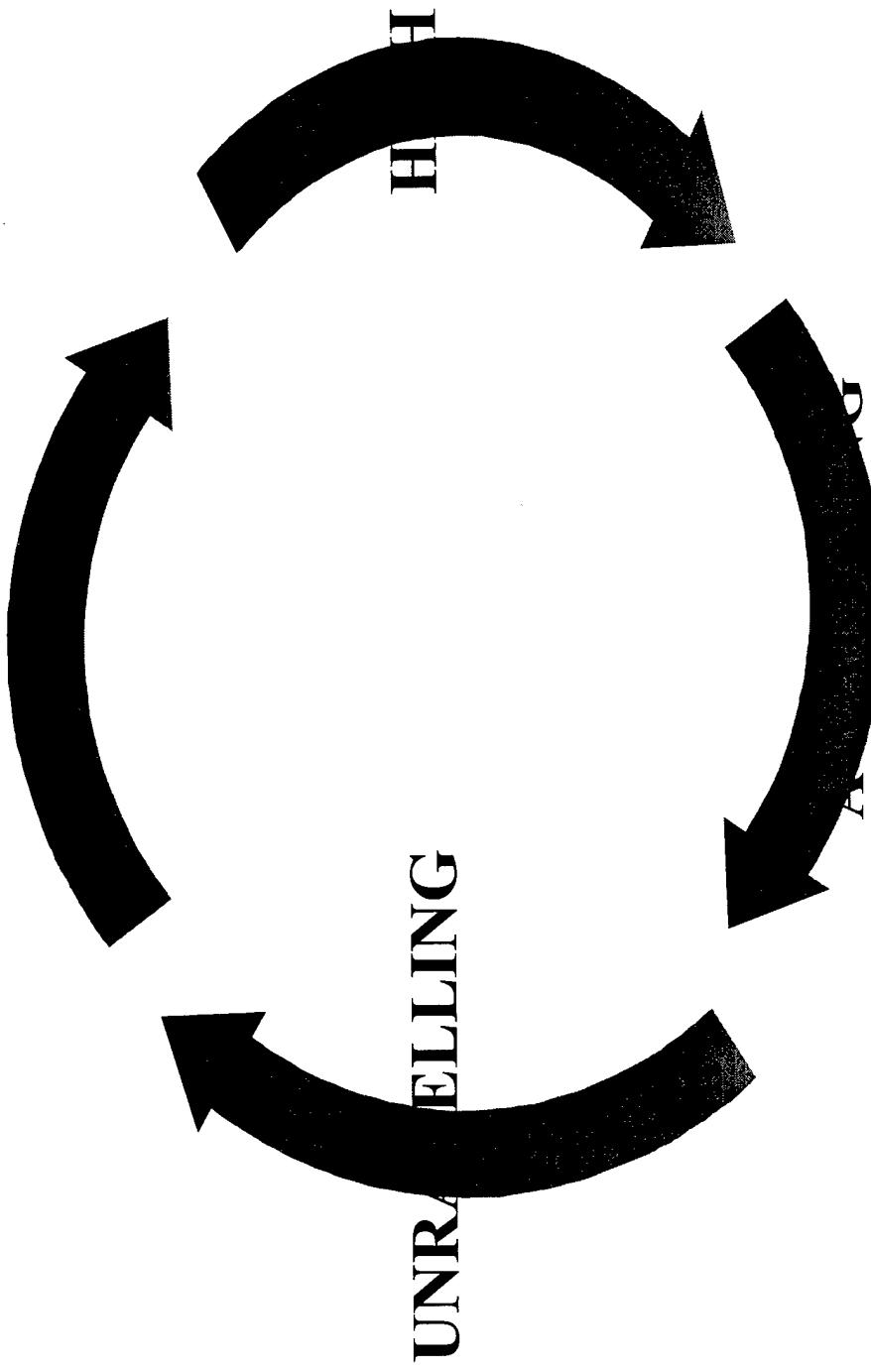
Millennium Conflict Features?

- ◆ Politically chaotic and ethically messy
- ◆ Likely to involve urban areas with civilians as pawns
- ◆ Prize might be technology advantage, labour, knowledge, capital investment; not territory?
- ◆ High-priority conflict termination objective will be sustaining legitimacy and ethos

An Effective Military Community for the 21st Century

The
Challenges
of
Building
a Military
Ethos

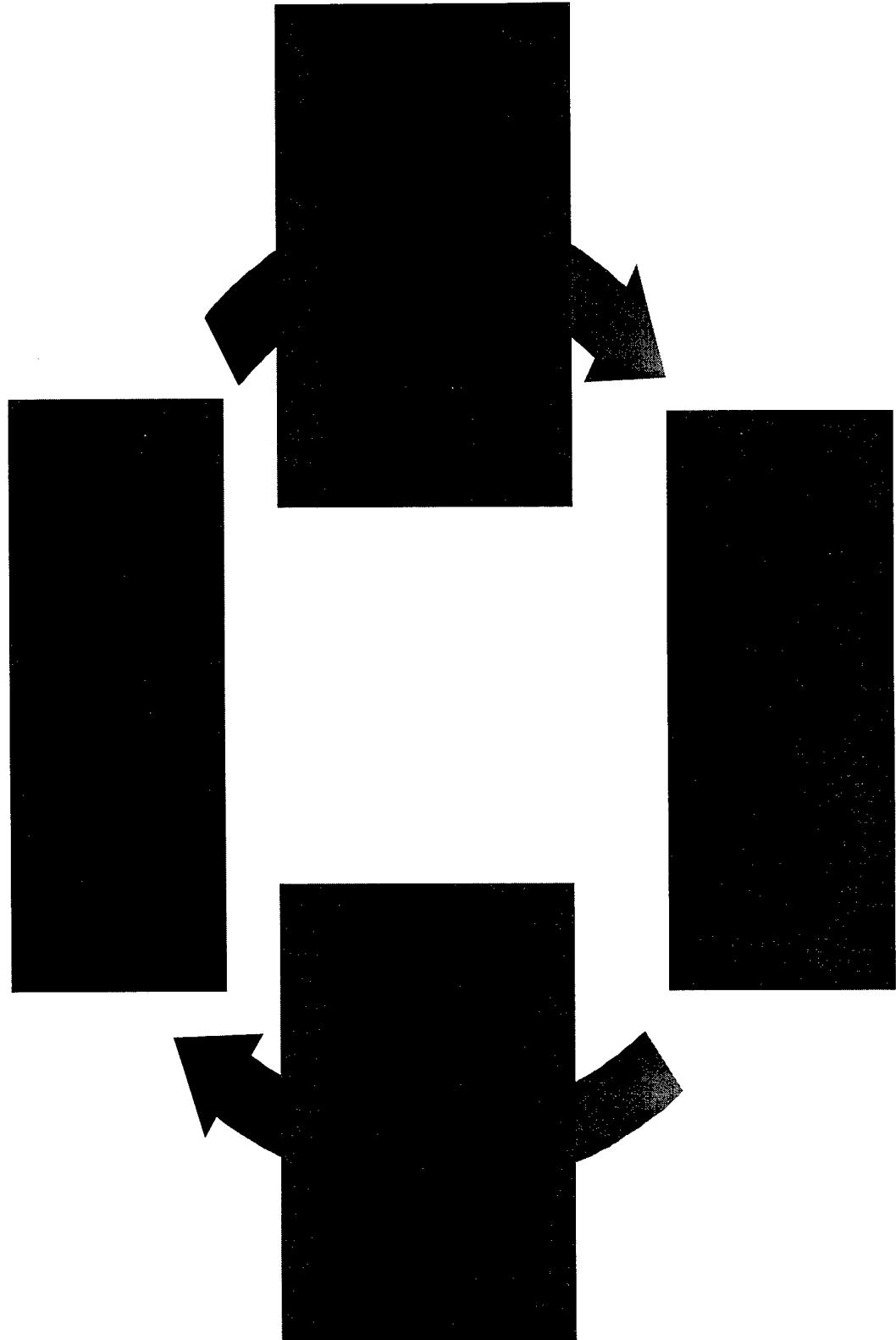
An Effective Military Community for the 21st Century



The
Challenges
of
Building
a Military
Ethos

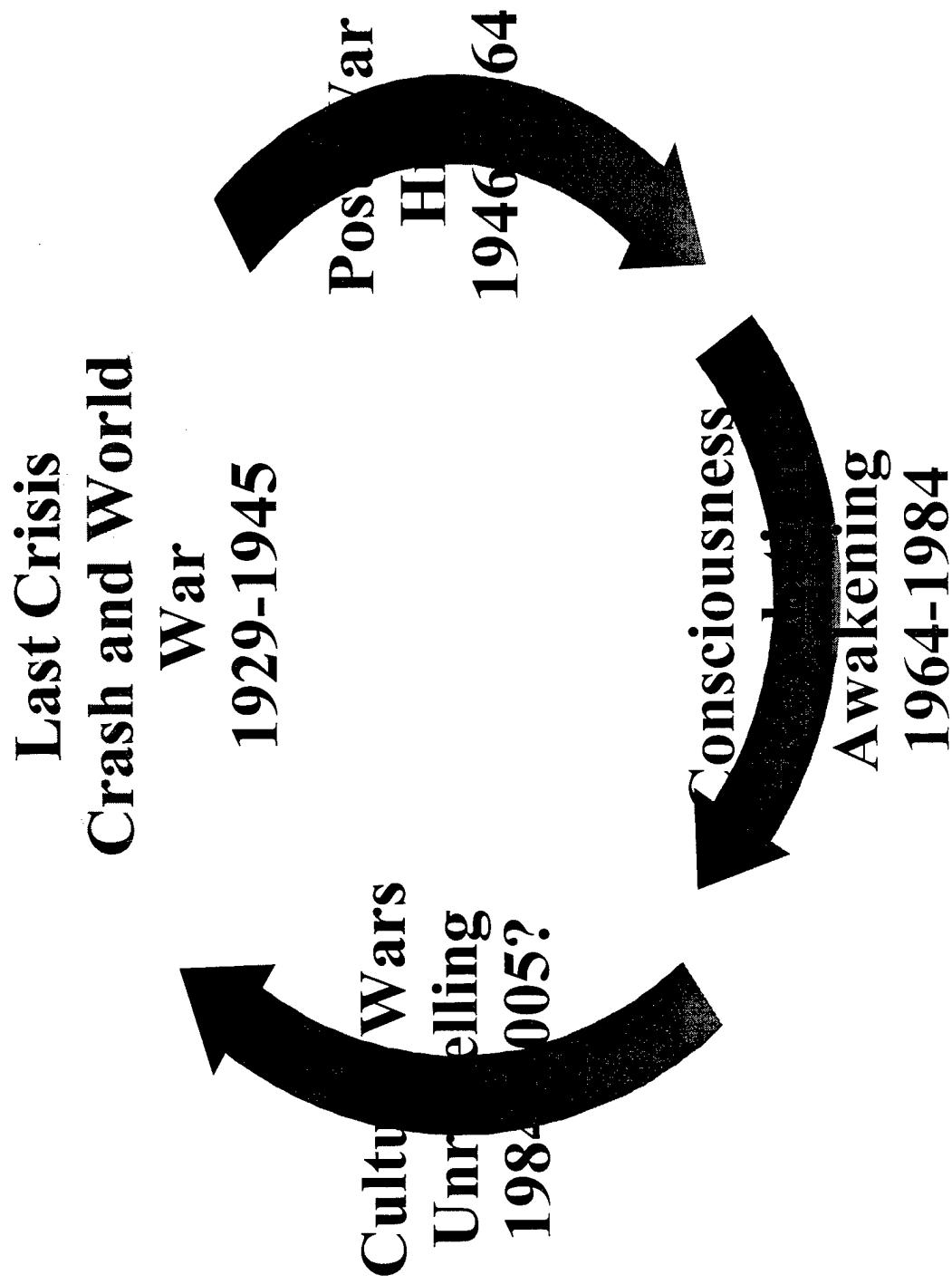
Cycles of Social, Economic, Political Change in Western Societies

An Effective Military Community for the 21st Century



The
Challenges
of
Building
a Military
Ethos

An Effective Military Community for the 21st Century



The Challenges
of
Building
a Military
Ethos

An Effective Military Community for the 21st Century

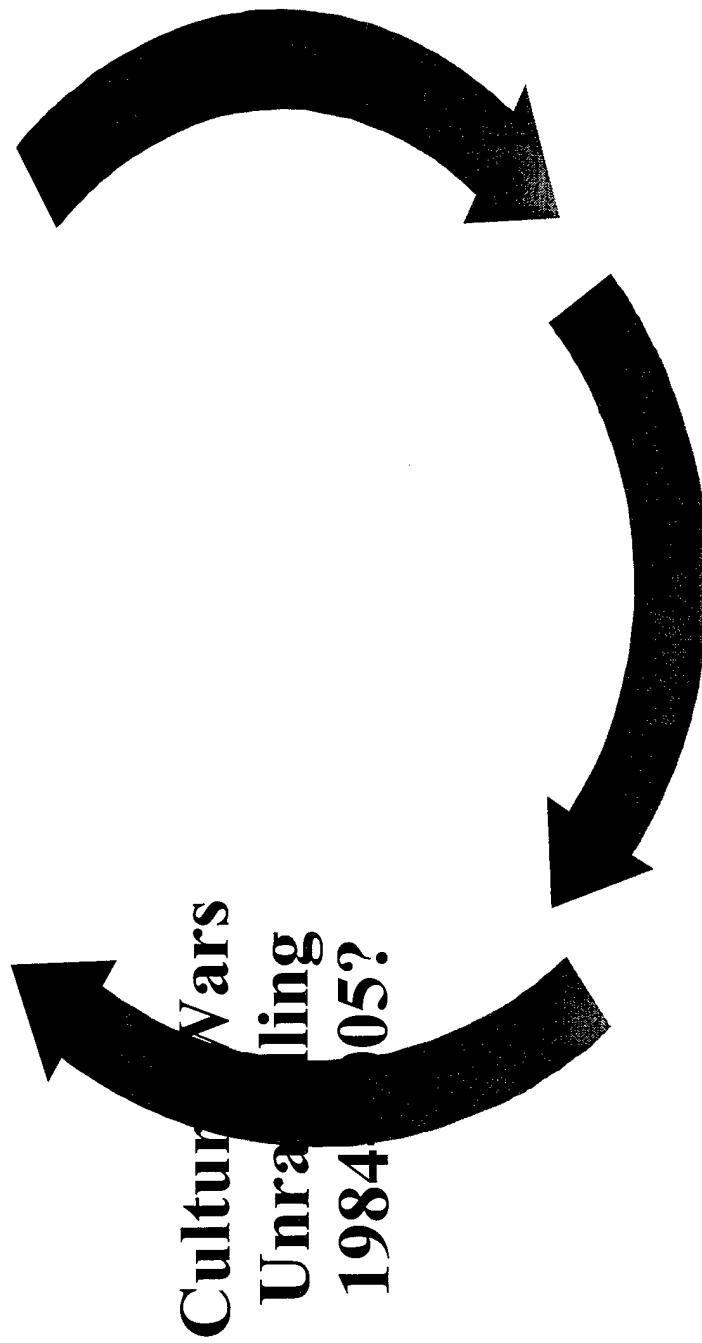
The
Challenges
of
Building
a Military
Ethos

Wars
Unraveling
1984-2005?

- individualism strengthens
- civic institutions weaken
- social groupings fragment
- questions of what kind of country, people we are start to dominate
- trust in public institutions weakens
- faith in big institutional solutions to solve public problems decreases

The Millennium Crisis?

Millennium
Crisis
2005?-2026?



The
Challenges
of
Building
a Military
Ethos

Finding the Social Capital in Generation X and Y

- Decline of social capital in society
- Individualist Values of Millenium generations
- Finding the Community in the Individual

Carving out an Ethical Space for the Military Profession

The
Challenges
of
Building
a Military
Ethos

- Should the Army mirror American social values?

- How far apart from American society should the US military profession stand?

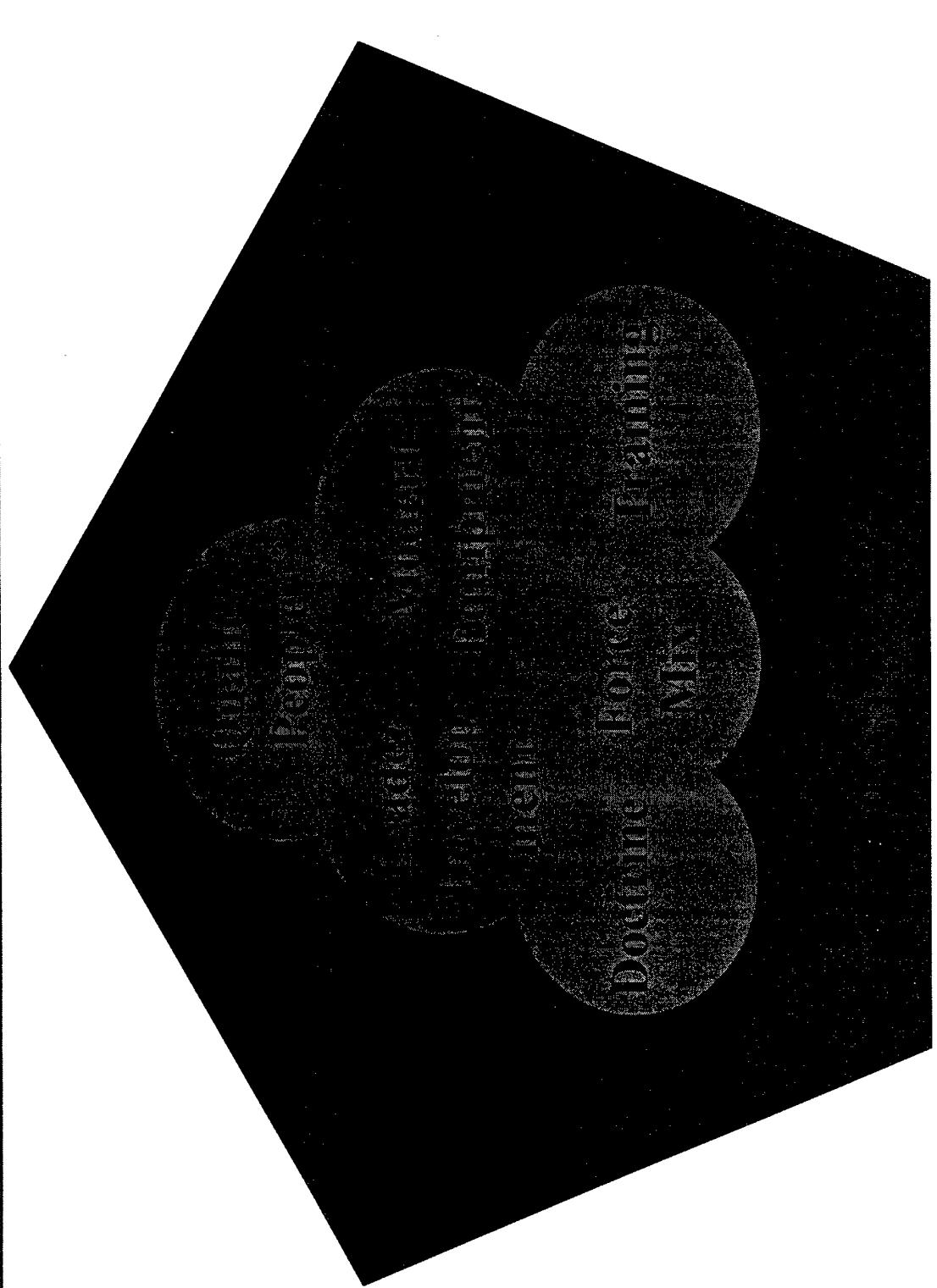
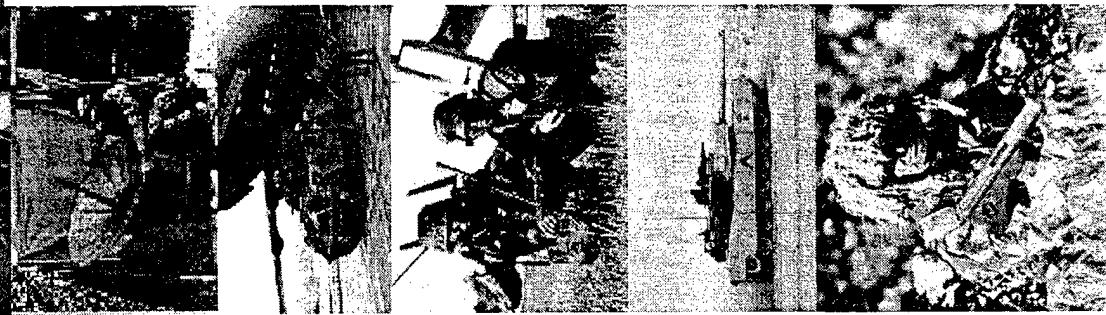
Information Age Challenges

- Declining levels of social capital
- Increasing oversight and transaction cost in time and money
- Growing rigidity of Legal/Bureaucractic controls



Future War-fighting
Concept:
Joint Vision 2010
Information Dominance
Precision Strike
Speed/Mobility

To be effective an Army needs to be Ethos-Directed



An Ethos-Directed Army for the 21st Century

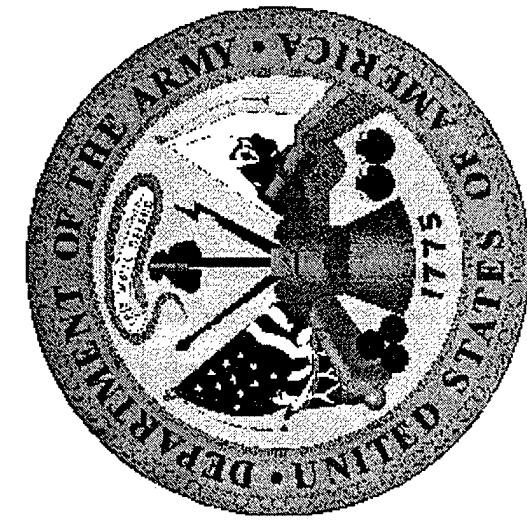
Cause

Community

Leadership

Profession

Ethics



Military Leadership Into the 21st Century: Another "Bridge Too far?"

Walter F. Ulmer, Jr. 1 November 1997

This informal paper notes our Army's remarkable recent performance under extraordinary stress, and considers the possible resulting institutional erosion as responsiveness to immediate missions continues to overwhelm human systems. It reviews and compares "best practice" in leadership development. It also discusses the combined impact of the typical general officer personality and the warrior ethic on leader behavior. A list of essential characteristics of 21st Century leaders is formulated along with recommendations for their attainment. The key issue, however, is not the *description* of desired characteristics and competencies. It is their *instillment and sustainment*.

Today Before Tomorrow

Before speculating about military leadership in the 21st Century it seems prudent to scan the status quo. That task is somewhat daunting. The condition of America's Army today--the combined result of enormous changes in the social, technological, political, and geopolitical environments of the last thirty years--is unclear. Inherently complex organizational and cultural circumstances are difficult to assess. The tendency among supporters to protect a noble institution from abuse by critics complicates a reasoned review. The infectious enthusiasm observed in good platoons could divert any search for deeper institutional problems. The worldwide reputation of relative American military power may be at an all time high. In any case, a look at some of the prevailing human systems in the Army, and the connections to present and future "leadership," is in order.

On 15 September of this year 620 members of the 82d Airborne Division parachuted into Shymkent, Kazakstan after a 19-hour flight from Fort Bragg. Genghis Khan would have been impressed. En route to the drop zone the C-17's might have passed over American soldiers on the ground in Senegal or Uganda or Brazzaville or Macedonia. While this military exercise involving armies of the former Soviet Union received some notice in the press, there was little expressed amazement. The American people took it for granted that our Armed Forces were up to the task. Fighting forest fires in Colorado, operating medical clinics in Latin America, retrieving Soviet nuclear weapons, policing Haiti or Bosnia, keeping the North Koreans at bay, seemed unremarkable. Similarly, effectiveness in Hurricane Andrew recovery, with flood relief in Bangladesh, and with the Saudi National Guard was not unexpected. Even in the midst of headlines describing appalling behavior on the part of cadre members at Aberdeen earlier this year, opinion polls continued to show strong support for the American military. Perhaps most remarkably, heroic actions of soldiers from Panama to Mogadishu to the Gulf confirmed that the tradition of courage under fire has not been lost.

The "peacekeeping," "warfighting training," "drug interdiction," "Olympic Games protection," and "stability" adventures took place amid a force reduction of monumental proportions. In a "drawdown" of more than one-third strength in five years, with massive personnel turbulence in a notoriously high operating tempo and an austere operating

budget, pride prevailed. In 1996, Army deployments averaged 35,000 soldiers per day among 70 countries. Many soldiers stationed in the United States spent more than 130 days away from home station. Much of the warrior spirit has somehow survived the influx from a supposedly self-centered generation. West Point cadets still compete for assignments in the combat arms. "Exciting but demanding times," some soldiers have said. It is doubtful our most robust corporations could have withstood the trauma to which the Army has responded so well in the 1990's. Performance of assigned, tangible missions in the last decade represents one of the finest examples of institutional stamina, commitment, and versatility in military history. **Still, there appears to be a growing unease among informed observers regarding the capacity of American Armed Forces to sustain operational excellence in the decades ahead.**

Erosion Amid Success

In an August 1997 press conference, the CJCS acknowledged that there were "cracks" in unit readiness. Strong anecdotal evidence to the same point has been emerging for several years. Some service members indicate they no longer recommend that their children enter the Armed Forces. Talented young officers appear to be leaving in disproportionately high numbers, although documentation for this is absent. The exodus of helicopter pilots has been described as a "hemorrhage."¹ A 1997 survey of several thousand soldiers conducted as part of the investigation of abuse of authority at Aberdeen and elsewhere reported that less than half of the respondents replied positively to questions of confidence in their leaders. A survey sponsored by the Command and General Staff College in 1995 found some concerns about leadership and the command climate strikingly similar to those reported in the 1970 Army War College *Study On Military Professionalism*.² Articles in military journals increasingly include comments to the effect that innovation is being crowded out by fear of failure ("Fear Of Mistakes Throttles Initiative In The Ranks," says one headline.) Thoughtful pieces by retired officers such as Lloyd Matthews and John Faith in *Army* magazine argue that both personality and systemic factors undercut aspects of professionalism in the officer corps.³ A House National Security Committee notes its concern that senior officials may not be admitting degradations in combat readiness. Many Senior Service College students in recent classes seem to display more than typical student skepticism about the quality of senior leaders they have observed.⁴ There are just too many credible anecdotes of poor leadership, particularly at the field grade and general officer levels, to ignore.

It is noteworthy that much of the data revealing troublesome trends have come not from a tabloid reporter's notes, but from Army surveys and analyses that have been made available for public scrutiny. It is also noteworthy that the same phenomenon revealed in the 1970 Army War College *Study On Military Professionalism* and the 1971 Army War College study on *Leadership for the 1970's* is present today: dramatically different climates exist simultaneously within the Army. Where enthusiasm and trust reside in one unit, frustration and anxiety abide in another, although a generalized high level of stress is clearly present today. Good leadership may not be able to compensate for incoherence in the web of strategic policies. But clear differences in morale and esprit among units of the same type provide another validation of the crucial role of organizational leadership.

The task in reviewing these bits and pieces of data is to question context and provide perspective. But the most optimistic reading of collective quantitative and anecdotal information on the current state of morale is discomforting. Measures of stress, trust, commitment, and morale have shown problems over many years. The confluence of organizational and environmental pressures at this moment, however, present institutional challenges of a different order of magnitude. A healthy job market for officers who leave the service, the lack of a clear military threat to the United States, the higher expectations for a "decent family life," and less tolerance among capable young people for poor leadership climates are a potent mixture. The crux of the matter seems clear. It is a tale of dedication and commitment that has produced local miracles while in effect neglecting and hazarding the future of the institution. The Army's culture promotes immediate response to "taskings" without proper regard for the collective long-term consequences of such response. **This focus on immediate mission along with the institutional systems in place that cater to conspicuous short-term results represent major challenges to both current and future leadership.**

Leadership In the 21st Century Army

In any Army, in any time, the purpose of "leadership" is to get the job done. Competent military leaders develop trust, focus effort, clarify objectives, inspire confidence, build teams, set the example, keep hope alive, and rationalize sacrifice. For this century or the next, there is little mystery about requisite leader competencies or behaviors. Desirable qualities and skills may vary a bit, but the basic formula for leader success has changed little in 2000 years. However, the method for routinely inculcating, supporting, and sustaining the desired leader behaviors has yet to be determined. The link between concept and practice is the heart of the matter. Certainly the progress in human systems design has been outpaced by technological advances. Also during the last 30 years, societal changes have produced higher expectations about what constitutes appropriate leader behavior in all sectors of American society.

A variety of studies have listed the essential competencies for 21st Century leaders in different societal sectors.⁵ They have typically included: an ability to deal with cognitive complexity; tolerance of ambiguity; intellectual flexibility; a meaningful level of self-awareness; and an enhanced understanding of the relationships among organizational sub-systems that collectively construct the prevailing "climate." These competencies would supplement the timeless leader qualities such as integrity, high energy, courage, and commitment to institutional values.

A 1982 report from the Walter Reed Army Institute for Research noted the need for leaders to attend to sustaining "intellectual and cognitive effort" when future warfare will have a pace, intensity, and technological complexity of unprecedented dimensions. The author is particularly insightful in discussing the need for leaders to be able to "...not only maximize the probability of successfully completing their current mission, but to conserve what [human] resources they can for the mission that will surely follow."⁶ The basic cognitive and emotional demands of the future battlefield as we now describe it in Army After Next (AAN) literature have been recognized for decades. However, strong conclusions about required competencies and behaviors have rarely produced powerful

new policies designed to support the development of the heralded attributes. (A discussion of "best practice" in critical human resources development matters will be provided later on in this paper.)

In an interview reported in the June 30, 1997 *Army Times*, the departing CJCS noted that future leadership demands would be generated by the "unprecedented stress," "isolated battles," and "dispersion" of the future battlefield. At his September 9 confirmation hearing the incoming Chairman said, "People are more important than hardware. We cannot allow the quality of the force to suffer." The CSA mentioned in an interview in August 1997 that the future Army "...is going to have to be more agile--strategically, operationally, and tactically. It's going to have to be more...versatile." The 1996 symposium on "Leadership challenges of the 21st Century" included thoughtful descriptions of leader competencies relevant to those battlefield stresses and doctrines. A February 1997 draft of a new FM 22-100, *Army Leadership*, included attention to the future requirement for leaders' continuous learning, and introduced a major conceptual breakthrough. This was the distinction between a leader's need to "operate" or achieve well-defined short-term goals, and the need to "improve" the workings of the system and thereby sustain the institution over the long term. How this will read in the published version of FM 22-100, replacing the 1990 edition, is unclear. The Army comes to grips more easily with operational and structural change than with modification of leadership doctrine or practice.

In a September 1993 issue of *Army Focus* magazine, then CSA Gordon Sullivan noted thoughtfully and persuasively that "The times we live in are times of profound change...political, ideological, and technical. We must adapt to that change and we must grow." Such "growth" of course would have to entail new perspectives, new learnings, and for the most part, new behaviors on the part of senior officers. Since they initiate and orchestrate organizational change, their performance as part of any change strategy is crucial. Yet in this 42-page magazine describing future demands on the Army and its response to those demands, one-half page is devoted to leader development. Further, nothing is mentioned about the task of building and sustaining climates that undergird any "learning organization."⁷

The July 1997 *Annual Report on The Army After Next Project to the Chief of Staff of the Army* used less than a page of the sixty page report to discuss human issues. The leadership issues that were addressed were unrefined, unexplained, and unexplored. Relatively cavalier coverage of human dynamics is typical of brochures describing the "Army After Next" and the "Revolution in Military Affairs" (RMA). Earl H. Tilford, Jr. in *The Revolution In Military Affairs: Prospects and Cautions*, a July 23, 1995 Strategic Studies Institute report, concludes that "Discussions of the...RMA...often develop along technological lines...what is lost...is the nature of war, which remains a complex interaction of political objectives, human emotions, cultural and ethnic factors, and military skills." The CSA remarked after the Advanced Warfighting Experiment (AWE) at the National Training Center last Spring that the AWE "...is not necessarily about technology, although that's an important part of it. It's about changing an Army.... most of all changing the culture."⁸

"Changing the culture" is a leadership task. So far, there appears to be no strategic design

for how to do it.⁹ This seems the case even with the present and prior CSA being individuals with remarkable insight concerning the challenges ahead, and with strong reputations as thoughtful leaders. However, a mountain of immediate crises both in Washington and the field, combined with the reality of mixed appreciation of the need for "cultural change" among serving Army general officers, seem to have colluded to put non-technical macro issues on the back burner. The robust agility that characterizes a progressive and adaptable organization that can handle the Haiti's, the Bosnia's, and the Korea's across decades does not derive from structure or weaponry alone. **The fact of the matter is that development of technological applications and operational procedures continues to capture a disproportionate share of the institution's creative energy even though we acknowledge that soldiers--not machines or structures--ultimately determine battle outcomes.**

Searching for Contemporary "Best Practice"

Much of my work over the past thirteen years has been associated with leadership in the non-governmental sectors. Large, complex organizations of every type are more alike than different regarding the challenges of attracting, developing, and retaining talented people. The greatest similarities in leadership competencies are at the upper organizational levels. Of course there are fundamental differences between the civilian and military sectors that impact on leader selection and development. First, there is only one American Army. One cannot transfer out of that army without also leaving the institution. The executive who is unhappy at GM might find employment of a similar nature at Ford. But the Army officer who becomes frustrated in his job must either bear up or exit the profession. Second, an employment contract with Sears or GE does not include sacrifice of life if necessary to take the objective. Commitment to the commercial organization is finite. Third, the military leader-follower relationship is supported by law and tradition as well as by local policies. Fourth, all senior military leaders have been promoted from within the ranks of the organization. And to these basic differences we add the warrior ethos essential to an effective fighting force. This philosophical orientation combined with common endurance of hardship forms interpersonal bonds rarely seen in the commercial world. Tight bonding within a strong culture can produce both wonderful team efforts toward the mission as well as conservatism regarding institutional change. It is an historical rarity that any institution revitalizes itself without enormous external pressures. (It is likewise true that strong authoritarian cultures have the potential for dramatic directional change if the collective leadership is so inclined. Integration of minority members into the U.S. Army in the 1960's is an example.)¹⁰

Before proceeding with the following seven comparisons about "best practice," there are three assumptions relevant to the discussion. One is that a supportive, rational organizational climate is essential for the attraction, motivation, and development of high-quality people. Another is that such organizational climates are greatly influenced--for better or worse--by the values, insights, skills, and behaviors of the senior leadership of the organization.¹¹ Last is the reality that competition for high-quality people is becoming increasingly stiff. All the while, both social mores (the acceptability of short-term employment relationships) and organizational change (the attending anxiety of instability and "downsizing") undermine long-term commitment to any organization.

I. Early opportunities for varied responsibilities that can support leader development.

Here, the Army is ahead of everybody. No institution does it better. Lieutenants have opportunities to lead groups of significant size in challenging tasks. They are exposed to command and staff relationships and resource management early on. They have defined tasks along with a variety of ancillary duties. Young people in the corporate world often wait five to ten years for opportunities to head a project team or be responsible for an office of 20-40 people.

II. Production and articulation of "doctrine" for leader behavior.

This comparison is mixed, although the Army's doctrinal materials, the traditional warrior ethic, TRADOC schooling, and pre-commissioning education provide a package to reinforce leadership concepts unequalled in any sector of our society. The new FM 22-100, *Army Leadership*, could be a benchmark reference for leadership in organizations. More and more companies are formulating explicit standards for leader behavior, segmented for different echelons in the organization. Generally, in both commercial and military arenas, the higher the echelon, the less clear leadership doctrine becomes. The Army does not produce definitive, enforceable guidelines for senior leaders except at the extreme edge of the acceptable behavior envelope. Codes, principles, good examples, and selected proscriptions are plentiful. Perhaps reluctance to inhibit subordinate initiative has prevented the required surveillance of leadership techniques. No doubt the lack of reliable information about the prevailing relationships between senior and subordinate one or two levels down the chain of command has precluded timely interventions by senior officers whose keen interest in good leadership is unquestioned.

Whatever the cause, the dearth of practical guidelines and more importantly the lack of systematic monitoring permit too wide a range of leader behaviors. Non-productive behaviors are then taken to be doctrinally acceptable since they are seen as tolerated if not condoned. Most military doctrine at the operational and strategic levels is directly devoted to structure and force employment, albeit within the context of traditional values. There are no highly visible, heavily resourced current efforts to define and teach the creation and sustainment of organizational climates that challenge, inspire, and motivate all ranks. This remains the case even after highly visible fractures in organizational climates have generated public concern and surely alienated many commissioned and non-commissioned officers over the past two years. This doctrinal ambiguity is not true regarding Army "values." They have been clear in their essence throughout the years. The recently announced value set is consistent with the past and reinforces Army interest in values. These values of *Duty, Loyalty, Selfless Service, Honor, Courage, Respect, and Integrity* represent the core of a noble tradition. Announcing them is necessary and also insufficient. Corporations using "best practice" are devoting effort also toward value identification. The best companies are also serious about recrafting their leadership selection and development programs. The review of executive standards and style ("doctrine"), feedback techniques, mentoring, and measurement of leadership results. would have been difficult to find in the corporate world twenty years ago.¹²

III. Use of developmental feedback and mentoring.

"Best practice" in this area has left the Army behind. Army feedback and mentoring programs are most robust at the NCO and junior officer levels. Increasing numbers of large civilian organizations require mid-level (field grade equivalent) managers to participate in laboratory exercises that include structured, instrumented feedback from peers and subordinates. Programs for senior executives (general officer equivalent) which incorporate behavioral feedback from observers at the work site are increasingly popular.¹³ The Officer Efficiency Report, even when the prescribed counseling is conducted, is a crude instrument for commenting usefully on individual strengths and weaknesses. The complex task of giving developmental feedback to subordinates is not taught in the Army school system. The Army War College has included some behavioral feedback in its program in recent years, but it is unlikely that there is the essential follow up in the students' next organization to exploit the process. The first dose of deeper insight in this area may come from the Leadership Development Program conducted by the Center for Creative Leadership (CCL) that is available to brigadier general selectees.

The reason for higher acceptance of developmental feedback in the for-profit world is no secret. Too many executives were and are failing, at great cost to the organizations. It is not possible to determine exact "failure" rates at the general manager and higher levels. Estimates made over the past decade range from thirty to sixty percent. There are no known sources of hard data about Army leaders. In both cases the definition of "failure" is imprecise. If one were to query serving officers about the percentage of battalion, brigade, division, and corps commanders who were seen as unsatisfactory leaders by a plurality of their subordinates and by many of their peers I suspect the figure would be between fifteen and twenty-five percent. Actually, there have been enough informal surveys, anecdotal reports, and ancillary studies over the past twenty years to make this more than a "suspicion."¹⁴ It does seem that the Army has a lower failure rate in perceived leadership effectiveness at mid and senior levels than does corporate America. Possibly, Army systems are somehow more tolerant of some non-ethical varieties of marginal performance. Or perhaps Army selection and development systems are simply more reliable. Regardless, the ranges of estimated failure rates in both sectors are alarming. One out of five selected commanders who cannot gain the trust and confidence of subordinates is intolerable over the long term. Selection errors have an extraordinarily debilitating effect on both the commercial and governmental sectors. The larger institutional sin is that the majority of leader selection mistakes are preventable.

Some percentage of individuals seems to have been immunized from significant adult learning, either by genetic happenstance or by early developmental neglect. But a combination of conceptual training, developmental feedback, environmental support for continuous learning, a performance appraisal system that supports both development and selection, and a system for selecting future senior leaders that uses more than written reports from superiors in the organization can reduce greatly the failure rate. A program of formal mentoring can assist in the developmental and in the assignment and selection processes. Mentoring and coaching have long been in the Army lexicon. Routine use of these techniques in the Army is a highly localized phenomenon, depending on the interests and skills of the unit leaders. There is no meaningful institutional motivation for being a good coach, yet that skill is highly prized by subordinates at every level.

Mentoring is done more routinely at junior levels than with field grade and general officers. Most formal mentoring practices in corporations are pairings of a junior and a senior. Even in this design the senior as well as the junior typically learns because of the relationship. Where all leaders must seek and identify one or more mentors from among their peers, superiors, subordinates, or outsiders, and then record their insights over time, even more learning takes place. While there are potential downsides to a formal mentoring program, including perceptions of favoritism or cronyism and some diversions of energy from the immediate task, the consensus is that mentoring programs pay their way.¹⁵

The Officer Efficiency Report (OER) to be introduced in the Fall of 1997 may reemphasize the need for coaching or counseling as part of the process. Junior officers will be well served by this increased emphasis. Suggestions regarding style and impact of leadership may continue to be excluded from most counseling of officers above the company grade level. Junior officers will benefit also from an innovative administrative policy that will keep OER's of the lieutenant years out of the hands of selection boards for promotions above the grade of captain. Here we have a fine example of a breakthrough policy that reinforces in practice the pronouncements about providing opportunities to learn without penalty. The new OER compromises its potential as a developmental tool. It apparently highlights numerical ratings, avoiding even locally contained feedback except from the superior perspective. It will unfortunately be administered at least initially in a climate that is viewed as ever more competitive, exhausting, and unforgiving.

Broad performance feedback at the organizational level is uncommon in both the military and corporate cultures. Often, businesses do agonize over last fiscal quarter's numbers to identify culprits when bottom line losses occur. The Army's after action review process for exploring the inner workings of tactical unit performance is a model of structured feedback not replicated routinely in the business world. That review process is often absent in the Army's non-tactical modus operandi. J.F.C. Fuller had it right in 1936 when he commented on the role of tactical critiques for teaching senior officers what they really should know: "...tactical exercises set to bring out...*tactical* lessons are not worth the setting. What an exercise should bring out *is the personality and common sense of the generals.*"¹⁶ Unit histories published long after the battle, postmortems on conspicuous calamities, and analytical exchanges held through local initiative are the exceptions.¹⁷ Contrarily, business journals and schools produce informative accounts of top leader successes and failures. The Harvard Business School may use more case studies on recent military management and leadership than do the military schools. Significant numbers of commanders of brigades and divisions and corps have strong reputations for great success or awful failure. However, the Army does not have a useful protocol for collecting and using the gamut of rich lessons that could be distilled from these experiences. There is no comprehensive, structured after action review at the conclusion of a command tour. Would not the Schwarzkopf-Franks controversy hold productive lessons about wartime relationships among senior commanders?¹⁸ There are methods to tap into these cases that would compromise neither unit nor individual privacy. The collective capacity of mid and top level executives to learn about themselves and their profession is the critical factor in organizational learning.

IV. Routine Use of Measures of the Organizational Climate

The Army is behind corporate "best practice" in this initiative. There is no regularly administered Army survey to measure important elements of a command climate. Had one been in place many of the derogatory headlines of 1997 could have been avoided. Morale, mission focus, clarity of priorities, effectiveness of communication, trust in leaders, confidence to perform mission essential tasks, perceived level of discipline, support for initiative and innovation, and fair treatment of all personnel are not systematically recorded. Crises sometimes bring on special surveys such as the recent look at sexual harassment and abuse of authority. Some elements of the Army--such as parts of the Army Material Command in recent years--have completed extensive organizational surveys along with instruments that provide feedback on leader behavior. Usually these are the products of a particular commander who has knowledge of the potential of these questionnaires. Progressive commercial organizations routinely use climate surveys to articulate organizational values, sense strong and weak aspects of the environment, coach managers, and sometimes contribute to assignment or promotion decisions.¹⁹ The Army forcefully and frequently collects data on equipment and financial readiness (the outmoded and simplistic monthly Unit Readiness Report, for example). The absence of a parallel reporting emphasis on the state of the human component relegates that aspect of combat readiness de facto to a secondary position. Recent focus on measuring optempo is a positive move in this area. An innovation with considerable potential is the *Ethical Climate Assessment Survey (ECAS)* that was gently introduced in draft form earlier this year. The ECAS provides a structure, and perhaps more importantly a rationale, for taking stock of the character of the organizational climate in useful terms. It was designed for informal, optional use by commanders in the field. If supported by the TRADOC school system and appreciated by commanders it could lead to generalized improvement.

V. Educating Leaders in Techniques for Assessing the Effectiveness of Individuals and Groups

Neither military nor corporate organizations do this well. Methods for measuring unit or individual efficiency and effectiveness are the most neglected element in managerial education. There is an assumption of leader competence to perform these delicate and important tasks. Army doctrine does not cover methods of personal or unit evaluation except in domains of individual soldier skills and small unit tactical operations. The Observer Controllers at the Combat Training Centers carry away unique competence in critiquing tactical actions. Interestingly, the critique of leader behavior has been an important shadow operation slipped into debriefings or informal conversations. At the Battle Command Training Program for senior leaders and staffs, the same situation usually pertains.

The Army and many corporations have used assessment center technology in one form or another for leader development, and in a few cases for leader selection and assignment. Assessment center methodology was first used in the United States by the OSS in World War II. The reliability of OSS operatives who passed the assessment screening was

mixed, but lessons from that experiment were significant and mostly disregarded. But assessment centers in use in institutions such as the Center for Creative Leadership (CCL) and other executive training programs and in several large corporations have been clearly useful in raising the self-awareness of participants. They most likely produce other salutatory developmental outcomes as well, including improved competencies for performance evaluation by the individuals who monitor the exercises. Army Recruiting Command and the Admissions Office at the U.S. Military Academy are among the Army entities that engaged in assessment center use in the past. Their findings indicate the utility of these techniques in enhancing the assessment skills of the staff members who conducted the exercises.²⁰

Executives (and a few Army generals) who attend CCL's senior program now participate in a simulation designed to hone their skills, or at least bolster their insights, in selecting a company president from among a batch of "qualified" candidates. Results here are similar to those obtained from long range studies done in AT&T and elsewhere: experienced leaders can enhance their skills at making critical assignment and promotion decisions through targeted training.²¹

Army doctrine does not address the very complex task of how to evaluate the performance of a subordinate on the job, how to apply available technologies to assist in this process, how to take advantage of research in this field, or how to take the temperature of the unit climate and exploit the results to enhance unit effectiveness. Remarkably, many commanders are doing it right anyway. But "many" is not enough. Interestingly, the October 1983 version of FM 22-100, *Military Leadership*, advised its readers to "Avoid using statistics as a major method of evaluating units and motivating subordinates." But this wise guidance--supported clearly by pronouncements from the current and prior CSA--has not been translated into the coordinated institutional system required for its implementation.

VI. The Use of Multiple Sources of Input as the Basis for Promotion Decisions.

The leading American corporations are ahead of the Army in using "best practice" in making promotion decisions. "Best practice" regarding promotion requires that criteria be clear to all concerned, supported by and consistent with stated institutional values. After considerable exploration and trial, fostered by concern about the lack of consistent effectiveness of executive leadership and the ability to retain the identified "fast trackers" of the organization, many companies have evolved a system of multiple sources of information to support promotion decisions. (The scholarly literature has urged this approach for years.) Only in the last decade has the practice become routine in any but the most adventuresome work settings. The typical suspicion is that evaluation of people for either development or selection, but especially for selection, by anybody but the boss was intolerable. Such action was thought to undermine authority, lead to a "popularity contest," and be hostage to the softer interpersonal realm while the productivity criterion would be neglected. Yet the more closely we scrutinize either theory or practice, the more inadequate the exclusively top-down assessment of performance and potential appear.

"Transformational" leaders have been observed in both military and commercial settings as more effective than are leaders who rely heavily on transactional or management-by-

exception leadership styles.²² (This is being reconfirmed at junior levels by an ongoing ARI study of platoon leader and platoon sergeant behavior.) Some of the critical characteristics and behaviors of the transformational leader are often undisclosed to the boss but are glaringly evident to subordinates and frequently clear to peers. What the boss measures most reliably are immediate task accomplishment, structural decisions, and adherence to prescribed strategy. Perhaps this is why the Army has probably produced the most effective cadre of managers of short-term results--in addition to large numbers of true leaders-- on the planet.

Peer and subordinate descriptions have been used in some Army schools, in selected pre-commissioning programs, in some special training situations, and in a few units by commanders especially interested in leader development. They are apparently used routinely in the military services of a few other nations. They appear to remain unacceptable to the general officer corps as a whole. It is difficult to dispute the reality that in order to promote individuals who are in fact good leaders we must somehow measure their style of leadership. Only the led know for certain the leader's character in the areas of commitment to unit above self, moral courage, and consideration for others. This is the indisputably crucial element in leader assessment and development systems. If in fact we prize these values, some form of input from subordinates is required.

VII. Systemic Support for Continuous Learning

Corporate America is struggling with this issue, and the Army has approached it in piecemeal fashion. Adult learning is in vogue in the business world because of global competition. While there is a need to deal with the rapid obsolescence of technical subject matter, that is not the central challenge. The heart of the matter is not "what to learn," but "how to learn."

There is no corporation in the world that equals the Army's commitment to continuing formal education. Among the military services the Army leads the way in broad education of its leaders. A recent Army conference on professional military education noted the importance of the neglected "how to learn" issue.²³ This is another area where conceptual thinking in the Army is advanced but application of the knowledge is slow. It represents a dramatic difference from the aggressive implementation of digital information technologies that is driving the Advanced Warfighting Experiment.

Few institutions provide reliable support for the kind of learning or the kind of creativity and innovation that a rapidly changing and stressful environment demands.²⁴ The question, then, is how do we marshal our intellectual and operational resources to facilitate learning from our individual and collective experience? Workshops tailored specifically to "learning on the job" or "learning from experience" have been one method some corporations have put in place. Such workshops are conceptually similar in attempting to separate skill learning (which the Army does particularly well) from cognitive process awareness (which the Army and most corporations have not come to grips with). Workshops typically involve exercises that require the executives to carefully examine "how" they made specific significant decisions, good and bad. Journals, reflective thinking, work with concepts of adult learning and the emotional hurdles

accompanying that process, and ideas on use of mentors comprise the usual curriculum. The challenge is to implant methods for raising awareness about the cognitive and emotional processes that result in decisions. The core of the "learning" issue may be illustrated by a battalion commander's learning from an NTC incident where the advancing forces outran the range of supporting mortars. One lesson might be "I learned to displace the mortars more frequently so they can provide continuous coverage to the advancing troops." A deeper learning might be "I learned that I need to change my behavior and approach to the staff so that they can interrupt me if necessary to get timely approval to displace the mortars; or perhaps to delegate that authority to my S-3 or FSO."²⁵

In many respects the Army's attention to human factors is unmatched by other sectors. Building on sincere traditional concerns for compassion as well as for operational competence, many units are notably well led today even as they remain overcommitted. Additionally, the Army has a vast but scattered knowledge base that covers the full spectrum of the behavioral, cognitive, and social sciences. **But the larger reality is that the Army does not incorporate pertinent and relatively inexpensive "best practices" in many of its key personnel activities.**

The General Officer Personality Factor

The Army's ability to cope with the challenges of the 21st Century will be determined largely by the collective values and abilities of its general officers. They will set and exemplify standards and create the policies and climates. For two decades the Center for Creative Leadership (CCL) has collected personality and behavioral data on corporate executives and Army brigadier generals. Most of these data have come from behavioral questionnaires completed by the participants and by people who have worked with and for them. Other insights have been collected as the generals participated in leaderless group exercises with their civilian classmates in the week long Leadership Development Program. Because much of the data are collected using standard psychological tests, many of the generals' results can be compared with that of groups in other sectors. As with all data comparisons there are inherent limitations. However, there is little doubt that the personality and competence indicators that support CCL studies are reputable. These findings have been reported in both academic and popular journals. They were originally presented by Dr. David Campbell in a 1987 paper that includes the following in the final paragraphs:²⁶

" ...general officers that we have now are outstanding--they are bright, well educated, experienced, responsible and well indoctrinated into democratic ways. Further, in the few ways we have to evaluate them in comparison with civilian leaders, generals come across as more impressive. In that regard, we are a fortunate society."

Dr. Campbell concludes also that the CCL data (which have changed little since the data collection began in the late 1970's, although CCL staff sense that today's generals appear somewhat more open and less insulated than those of a decade ago) are sufficient to identify a personality syndrome that he describes as "the aggressive adventurer." His description of that personality would be: "dominant, competitive, action-oriented patriotic

men who are drawn naturally to physically adventuresome militaristic activities..." Tests show reasonably high needs for "control," tendencies toward "dominance" well above the level of a typical manager, greater comfort with data than with intuition, and a high achievement orientation. Their counterparts in the corporate world have test scores only a bit closer to the population norm. This set of personality characteristics is highly desirable in many situations. He continued: "Despite my few misgivings, I am impressed by most of the officers that I have been working with....The other civilians in our courses who have worked with them for a week have been almost uniformly impressed by their intelligence, capabilities, and dedication to this country."

The above accolades notwithstanding, there is substantial evidence in the CCL data base--summarized in the "aggressive adventurer" description--of a typical personality type whose strengths and weaknesses should be carefully noted as we move into the next century. CCL and other research shows convincingly how strong points within a personality that served well to accomplish the tactical tasks of early managerial years can become dysfunctional when individuals move to the strategic level. Work by T. O. Jacobs²⁷ and others in the military community show similar patterns of differential impact of competencies as officers move up in rank. It seems rare that the "below the zone" battalion commander with marked accomplishments will have the inclination to review the suitability of his style for higher command. Again, the issue is that certain characteristics which are invaluable in a strong leader in any organization, and especially prized in the military--such as self-confidence, willingness to accept responsibility, a thirst for facts and hard data, and respect for the status quo--all have possible downsides. **Army policy formulation must take into consideration the typical senior officer personality, safeguarding the collective strengths as it consciously attempts to ameliorate the weaknesses.**

The Essential But Potentially Disruptive Warrior Ethic

Douglas MacArthur was right in 1962 in his parting address at West Point when he said that the mission of Army officers was to "fight wars." If we lose sight of that reality, nothing else will matter in the 21st Century. Our Army will become irrelevant at best and disavowed at worst. The issue here is how to sustain the warrior spirit while enhancing those aspects of the leader personality that will embrace change, agility, creativity, and self-awareness when the need for those attributes is paramount.²⁸

The "can do" attitude toward military tasks that we rightly prize coupled with the typical personality of our colonels and generals has a downside. Of all the services, the Army epitomizes the loyal servant mentality. It complains less in public about its resource levels. This cultural artifact has been noted in several studies. Carl Builder said in a 1987 talk that "The object of the Army's worship is the country....The Navy worships at the altar of tradition....The Air Force worships at the fountain of technology."²⁹ Samuel Huntington wrote in 1957 "...the Army developed an image of itself as the governments' obedient handyman performing without question or hesitation the jobs assigned to it." In a fascinating 1996 dissertation, Stephen Scroggs concluded that the Army is less effective in its relations with Congress than are the other services because of the Army's sense of unseemliness in operating aggressively outside its institutional boundaries.³⁰

The warrior ethic does more than set expectations for heroic competence on the battlefield. It also sets the stage for leader behaviors. The primary positive behavior, at the heart of the professional tradition, is the concept of self-sacrifice. This value, remarkably alive amid a professed self-centered society, distinguishes the soldier and supports tactical success. Because obedience is correctly entwined with sacrifice and loyal commitment, and because warfare demands discipline, the need for a hierarchical organization persists even in the shadow of technological change. Arguments to the contrary have not been confirmed in practice.

The impediment to optimal organizational functioning arises from failure to recognize that the efficacy and *de facto* legitimacy of the authoritarian mode differs dramatically depending on the situation. There really are only two "different situations" the leader must confront. As mentioned earlier, there is the situation where immediate action and centralized control are the guiding parameters. This is the "operating" situation. There is need for standard procedures and "crew drills." There are expectations for prompt, discernible, measurable results. The linkage between cause and effect is clear. Hard data are usually available for decisionmaking. Reflection or contemplation is out of place. The typical general officer/CEO personality fits well into this situation. This tendency of personality is reinforced in the junior leadership years when prompt, aggressive control of the tactical situation represents laudatory behavior. The other type situation gives the general officer/CEO personality more trouble. It requires contemplation before action, patience with ambiguity, and a willingness to allow broad participation in the decisionmaking process. This is the "building" or "improving" situation. Its focus is on sustaining or improving the strategic situation, on protecting institutional values, on reconfiguring organizational systems, on investing in basic research and education, on taking time to coach and mentor. Tenuous links exist between cause and effect, with results difficult to quantify. Often there are incomplete or conflicting data from multiple sources. Skilled leaders are able to recognize these two situations. Then, more importantly, they must be able to shift from one set of leader behaviors to another. The Army system of performance appraisal and reward loads on the side of the "operating" mode. This bias is reinforced by such behavior modifiers as the monthly "readiness" reporting juggernaut that highlights the measurable and not necessarily the important. Then we compound the problem with relatively limited time in any one assignment that hardly allows a leader to gain trust and to make seminal contributions. In effect, everything about the current system moves leadership style relentlessly toward the "operating" end of the spectrum.

The warrior ethic, precious as the ultimate glue of the profession of arms, can rationalize leader behaviors that are situationally inappropriate. The classic example is the authoritarian leader whose penchant for centralized control results in poor decisions because his style denies him essential information. The idea long enunciated by Julius Becton, Jack Faith, Jack Galvin, George Marshall and others of their ilk that "Disagreement is not disloyalty" has not permeated the fabric of the institution.³¹ The support for absolute authority essential in battle can be a spawning ground for abuse of power. This is especially true if behavioral guidelines for the exercise of authority are sketchy. Fortunately, many officers are self-restrained, sensitive to the situation, respectful of others, able to tolerate ambiguity, open to ideas, and generally comfortable

with themselves, while also being mission-oriented. There are no indications that the environment of the 21st Century will be less challenging for leaders than is the 20th Century. **As military operations become ever more complex, and their environments more exacting, the boundaries of acceptable and productive leader behavior in different situations will become more restrictive.**

Another List of Requisite Leader Characteristics: "The Big Eight"

There are lists aplenty already. Most everything we "discover" or repackage about leadership has been recorded before. The compilation offered here might still be a useful refocus for theoreticians and practitioners. (The suggestions that follow after this section regarding education, readiness assessment, leadership learning, and selection and promotion are related to one or more of the items on this list.)

1. **Passion for Mission.** This characteristic includes "commitment" and "loyalty" but incorporates also the emotional intensity and the worthiness of self-sacrifice that the military profession in a democratic society demands.
2. **Moral Courage.** Moral courage always has been a leadership necessity. Its criticality has been heightened by the ethical fog that increasingly creeps over the decision landscape. Physical courage must never be taken for granted. However, strengths and weaknesses of the notable leaders of this century have more often been determined by moral courage in the face of ethical pressures than by physical courage in the face of enemy fire. Recent Army emphasis on articulation and inculcation of Army values should help to remind all ranks of the imperative of "moral courage." (Read Dereliction of Duty by H. R. McMaster to get a sickening feeling about the state of moral courage in Washington in the 1960's.)
3. **Decisionmaking Agility.** This characteristic addresses the requirement for intellectual capacity and flexibility that is needed to respond to complex situations. It has been described as general cognitive competency combined with the ability to discriminate rapidly among different levels of situational importance. It is not easily amenable to quantum change in adult years, but it can be facilitated or impeded by the environment.
4. **Comfort With Action.** It behooves us to remember that the journey is not the destination in the military. Bold use of force is at the heart of the profession. Individuals who do not have a natural desire or conscious intent to remain in the physical as well as the mental world may have a place in a specialization supporting military operations, but they cannot constitute the mainstream without hazarding the profession.
5. **Self Awareness.** There is a relationship between the accuracy of one's self-perception and the effectiveness of leadership; and also between self-awareness and the propensity for continuous learning. ("Self-awareness" has been seen traditionally as incidental to leader behavior, particularly within military institutions. This has been the reality although one of the Army's longstanding *Principles of Leadership* has been "Know yourself and seek self-improvement.")
6. **Sensitivity to Context.** Given the diverse missions, political constraints, and sometime

bizarre circumstances predicted for the 21st Century world, leaders must be alert to the nuances of their environment. They must also sense the context of their leadership situation and respond by moving their style toward the "operating" or the "improving" end of the behavior spectrum. ("Self-awareness" then helps them adopt the leadership style best suited to the particular situation.)

7. Capacity to Trust. "Trust" is the heart of leadership. A leader's capacity to reasonably trust others is essential in the leader-follower relationship.³² Further, all efforts toward "empowerment" or "decentralization" are directly related to the ability of the leader to "trust" and to "earn trust." When information flows unimpeded across the "digitized battlefield" as envisaged by FORCE XXI scenarios, there will be a need for absolute trust in the leader who now makes decisions from a data base that is shared with every subordinate. The capacity to trust may be deeply embedded in one's personality, perhaps molded in early childhood. Still, it can be mediated by an institutional setting that expects and rewards both trustworthy and trusting behaviors.

8. Commitment to Learn and Renew. Continuous learning by successful adults is counterintuitive. Yet the pace of change presses so heavily on occupational competence nowadays that even senior leaders have no choice. Adult learning rates are susceptible to modification by the priorities, climate, programs, and specific expectations of the institution. Leaders must dispassionately examine their institution and be willing to invest in the initiatives necessary to revitalize its climate and adjust its culture.

Systemic Adjustments to Support Army Leader Development

❖ Adjustments in the Educational System

The first adjustment has been identified or at least rediscovered in recent Army discussions. It is a move from "What to learn" to "How to learn." This can begin in basic courses for lieutenants and proceed through War College without distracting from mastery of essential technical skills. The "Estimate of the Situation" is in part a "how to learn" paradigm. However, it sometimes deteriorates into a rote incorporation of standard phrases into the text. There must be closer scrutiny of student research papers, greater use of analysis of prevailing procedures and doctrine, and creation in the classroom of a skeptical--if respectful--mindset. Case studies in leadership and management need to substitute for some of the repetitious of tactical scenarios. Excellent tactics will not compensate for lack of leadership in preparing units before the fight.

The second adjustment has been under consideration for years and implemented primarily at the basic skill levels where it has received mixed reviews. This is the move from a *selection and attendance* mode of common education to an *individualized and competence-based* mode of education. This new paradigm should impact primarily at the Command and General Staff level and War College levels. Instruction should be tailored to individual student needs. Length of residence would depend on a careful assessment of student needs, experience, and expectations. Student achievement should be based on demonstrated competence in written and oral examinations given when the student feels he is prepared for the individualized tests leading to a diploma. Some students may take

two years to complete the War College; others may take six months. There might be some minimum number of months in residence to gain the insights that come from residential membership in an academic setting. Significant credits toward graduation could be earned through prior "distance learning." Structured coaching in leader behavior and standards should continue in post-schooling assignments.

❖ *Adjustments in Unit Readiness Reporting*

"Unit readiness" and its reporting must be redefined to include assessments of cohesion, morale, and discipline in addition to the traditional measurements of equipment status and personnel fill.³³ Reporting intervals for major units should be changed from monthly to quarterly. This simple step would reduce the significant administrative effort now expended on a reporting process that is in disrepute at lower organizational levels. More importantly this change would provide a mild sense of liberation and empowerment to unit commanders, and a step cultural change to strengthen mutual trust within the chain of command.

A separate but related action would require periodic assessments of the organizational climate in a more comprehensive manner than through the quarterly readiness reports. There are instruments available for this purpose. The Army must explain instrument use to all interested audiences, incorporate relevant instruction on the proper use of standard questionnaires in the TRADOC schools, decide how the results of the surveys should be compiled and distributed, and be candid regarding their impact on commanders' records and reputations. The best model for climate surveys for the early years of their implementation is to provide unit results only to unit commanders, with higher headquarters receiving only consolidated reports. After a few years other modes of distribution of results should be considered. The questionnaires themselves would constitute a tutorial on Army expectations about organizational leadership.

❖ *Adjustments On How to Learn Leadership On the Job*

The issue here is feedback. It should come from two sources: a formal mentoring program and a supplement to the Officer Efficiency Report. Each field grade and general officer should be required to select two formal mentors. There should be a check mark on the OER support form confirming that two mentors have been identified and are participating. The specifics of "participation" should be broadly defined, with the TRADOC school system teaching the selection and role of mentors along with techniques for receiving and providing behavioral feedback. Mentors could be active or retired military, or civilian. Mentors can offer intimate and non-threatening feedback, and provide a confidential repository that the regular chain of command simply cannot.

At the end of a battalion-level command tour there would be a comprehensive analysis of the leadership strengths and weaknesses of the outgoing commander. This should be a separate, non-record procedure designed to assist in leader development. It should be formalized by Army regulation. Mentors should attend if practicable. Observers of the performance of the organization would provide input. General lessons learned would be provided to the TRADOC schools. These analytical, feedback sessions should be conducted by a specialized team outside the local chain of command, with participation

from that chain of command, and scheduled well after all OER's have been completed.

The support form or some attachment to the OER must provide feedback on behavior from peer and subordinate as well as from the superior. (Where this is being done in industry, there have been no reports that the chain of command has been ruptured as a result.) Information on behaviors, collected by a suitable questionnaire, should be provided initially only to the officer concerned. There are modalities for keeping feedback somewhat confidential as to actual source (using a minimum of five or six individuals who are not specifically identified, for example) and the feedback does not have to derive exclusively from current peers or subordinates. Again, if in fact leadership is important, leadership must be measured. We have found no way to verify the presence or absence of some crucial leader behaviors other than to query the followers. If the institution cannot come to grips with this fact, it will never reduce significantly the error rate in leader selection. The 21st Century competition for quality manpower will reduce even further the acceptable level of mistakes in military leader selection.

❖ *Adjustments in the Promotion System*

If properly implemented the revisions of career field groupings envisaged by OPMS XXI will provide a giant first step in adjusting the Army officer promotion system.³⁴ The de facto compartmentalized promotion quotas that will limit competition to within career groups and thereby incapacitate the system that now abandons combat arms officers who do not come through the battalion command screening.

The promotion process itself requires major surgery. Selection boards for promotions to the grade of lieutenant colonel and higher need a broader base of information. In addition to whatever OER data are in the file, there should be an application from the officer himself, indicating the positions for which he feels qualified and interested, and the special skills he has amassed over the years. The selection board the results of a canvas of peers and subordinates attesting to the leadership side of the personality. There should be a fresh query of former superiors, selected perhaps by the applicant, who would indicate on some scale the relative readiness for particular assignments of the individual being considered. The main point is to expand the useful information available to the boards. This protocol can be designed in a manner that does not subvert command authority. The judgment of selection board members would still reign supreme.

Selection of brigade-level commanders should be similar to the promotion scheme outlined above. Again, officers should apply for brigade command. They should have an opportunity to explain their career goals. This procedure would also offer an opportunity for quiet avoidance of the command selection process for those officers who have concluded that other options are more realistic for them.

The Critical Task Is Not To Define Requisite Leadership, But How To Develop and Sustain It

Leadership principles and lists of traits and descriptions of required situational behaviors will continue to flood the market, even though the basics of leadership that derive from

timeless human needs and aspirations have changed little in all of recorded history. Some future studies and the deductions therefrom will shed light. But our challenge is to move into the 21st Century with a good record of practice, not just a solid platform of theory. It is the record of practice to date that should give all of us who have participated some feelings of satisfaction along with profound concern and resolve to do better. Our Army has recovered from several some low points over the last hundred years. The revitalization between 1970 and 1990 is a monument to collective institutional commitment supported by creative Army leadership and an understanding public. Were we to sink again to a real low, there could be a serious question regarding the national capacity to restore the institution to what it must be. Bold initiatives now can ensure the future. "Good leadership" is essential not only as the ultimate force-multiplier but also as the primary guardian of the institution.

¹ A number of such assertions can be found in the popular press. The 1997 issues of *Army Times*, articles in *The Wall Street Journal*, an item in the September 22, 1997 *US News and World Report*, commentary in Service journals and other evidence would be unconvincing singularly. However, comments from the House National Security Committee as reported in the July 14 issue of *Army Times* and the findings from the recent large survey associated with sexual harassment, confirming other recent survey data, leave little doubt that there are more than superficial problems with elements of the climate of the Army. Other studies going back more than a decade (HQDA "Longitudinal Research on Officer Careers," and the 1985 "Professional Development of Officers Study," among others, found substantial levels of dissatisfaction.)

² From presentation by BG David Ohle at a conference on military ethics, Cantigny, 13 March 1996.

³ See, "The Overcontrolling Leader: The Issue Is Trust," *Army*, June 1997, by MG John C. Faith.

⁴ Personal discussions and informal surveys by the author.

⁵ A representative collection of papers describing future leader demands was presented at the *Leadership Challenges of the 21st Century Army Symposium*, March 18, 1996, prepared by the Institute for Management and leadership Research of Texas Tech University.

⁶ This 1982 publication, "The Future Battlefield: Human Dimensions and Implications for Doctrine and Research," WRAIR, Washington, D.C., has relevance for 21st Century leadership.

⁷ GEN (Ret) Gordon R. Sullivan is not naïve about concepts of "learning organizations." His book, Hope Is Not A Method, (1996) provides broad insights on the subject. But the institution struggles with the link between concept and practice.

⁸ GEN Dennis Reimer's quote in the March 31, 1997 issue of *Army Times* is consistent with his other comments on AWE implications. He has shown a keen awareness of the potential impact of the downsizing and high optempo on the organizational climate, and of AAN leadership challenges.

⁹ An excellent article on the subject is "Toward a New Institutional Culture: Creating the Officer Corps of the Future to Execute Force XXI Blitzkrieg," by Major Donald E. Vandergriff in the March-April 1997 issue of *Armor* magazine.

¹⁰ See All That We Can Be, Charles C. Moskos and John Sibley Butler, (1996) Basic Books.

¹¹ The impact of "climate" on trust, cohesion, and unit effectiveness has been validated in many studies. One good reference is the *ARI Newsletter*, Volume 9, June 1992 which relates leadership to small unit effectiveness. An ongoing ARI-sponsored study led by Dr. B. M. Bass will revisit some of these issues. Another important work on climate and trust is *Excellence in the Combat Arms* by Maj. J.A. Simonsen, CPT H.L. Frandsen, and CPT D.S. Hoopengardner, Naval Postgraduate School, December 1984.

¹² One of many overviews of issues and programs in the corporate world is The Working Leader: The Triumph of High Performance Over Conventional Management by Leonard R. Sayles. (1993) The Free Press. The Peters, Bennis, Waterman, and Drucker books have much the same kind of information.

¹³ A most convenient reference for 360-degree feedback and enhancement of self-awareness is the Summer And Fall 1993 Special Issue (Volume 32, Numbers 2 & 3) of *Human Resource Management*.

¹⁴ An Army War College Military Studies Project authored by Tilden Reid dated 5 June 1983 titled "Performance of Successful Brigade Commanders Who Were Selected to BG as Viewed by Their Former Battalion commanders" concluded that 28% of those BG's should not have been selected.

¹⁵ For a convenient overview of mentoring programs, see *Formal Mentoring Programs In Organizations: An annotated Bibliography*, Christina A. Douglas, (1997) Center for Creative Leadership.

¹⁶ J.F.C. Fuller, Generalship: Its Diseases and Their Cure (1936), p.76. Reprinted by Military Service Publishing Co., Harrisburg, PA, 1984.

¹⁷ Two exceptions were the 1986 *Fort Hood Leadership Study* prepared for HQDA-HRL by the Essex Corporation; and the September 1987 report on the formation of the 7th Infantry Division (Light) prepared by WRAIR as Technical Report No. 5. (The impact of these organizational analyses is unknown.)

¹⁸ Into the Storm: A Study in Command, Tom Clancy with General Fred Franks, Jr. (Ret.) (1997), G. P. Putnam's Sons, should stimulate professional discussion on issues of authority, style, and relationships.

¹⁹ The Army has considerable experience with a variety of surveys. There was once, and perhaps still is, a HQDA Pamphlet (600-69, 1 October 1986) that provided a convenient "Unit Climate Profile" format. One summary of corporate use can be found in Daniel R. Denison's 1984 article in *Organizational Dynamics*, "Bringing Corporate Culture To the Bottom Line." It is use of data, not the gathering of it, that has been the primary flaw in the Army's survey efforts.

²⁰ The Fort Benning Field Unit of the Army Research Institute and various offices at the U.S. Military Academy have conducted in-house research on assessment centers.

²¹ Managerial Lives In Transition: Advancing Age and changing Times, Howard, A. and Bray, D.W. (1988) The Guilford Press is a definitive, exhaustive work that supports the thesis that we can do better.

²² The 1994 book Improving Organizational Effectiveness Through Transformational Leadership edited by Bass and Avolio has since been updated with more support for the general thesis: transformational leadership produces productivity that is unequalled by other styles in the full range of leader behaviors.

²³ Professional Military Education: An Asset for Peace and Progress. Panel Report. The Center for Strategic & International Studies. Washington, D.C. March 1997.

²⁴ See McCall, Morgan W. Jr., et.al. The Lessons of Experience: How Successful Executives Develop On The Job. (1988) Lexington Books. This is about the best around on this subject.

²⁵ There has been a lot of good material produced in the past several years on the challenges "successful" adults have with their growth and continued learning. See, for example, Beyond Ambition: How Driven Managers Can Lead Better and Live Better by Robert E. Kaplan et. al. (1991) Jossey-Bass; and Ambition: How We Manage Success and Failure Throughout Our Lives by Gilbert Brim. (1992) Basic Books.

²⁶ David Campbell, "The Psychological Test Profiles of Brigadier Generals: Warmongers or Decisive Warriors?" Invited address, Division 14, American Psychological Association, New York City, August 30, 1987. This study data were updated at the Center for Creative Leadership in 1994 with no significant changes in the collective test scores of the general officers participating in CCL programs.

²⁷ Dr. T. O. Jacobs, formerly with ARI and now on the faculty of ICAF, has studied general officer capacities and competencies for three decades. His briefings on senior officer requirements have described, particularly in the cognitive domain, most of the requisites we now discuss as essential for leadership in the 21st Century.

²⁸ One good recent publication that mentions the challenge of selecting warriors from a peacetime force is a Naval Doctrine Command paper of July 1995 by Dr. James J. Tritten titled "Navy Combat Leadership for Tomorrow: Where Will We Get Such Men and Women?"

²⁹ "Mirrors to the Service's Personalities," by Carl H. Builder, then a member of the RAND staff, a luncheon presentation on 28 March 1987 to a conference on "The Air Force in the 21st Century."

³⁰ Scroggs, Stephen K. "Army Relations With Congress." Unpublished dissertation. Department of Political Science in the Graduate School of Duke University. (1996).

³¹ Part of the problem must rest on the shoulders of followers, albeit a small part. See The Courageous Follower: Standing Up and For Our Leaders by Ira Chaleff. (1995) Berrett-Koehler Publishers.

³² An excellent discussion on the role of trust is in Dale E. Zand's The Leadership Triad: Knowledge, Trust, and Power. (1997) Oxford University Press.

³³ The Report of the Defense Science Board Task Force On Readiness, June 1994, contains some good advice in the "Personnel" section. It mentions " Demonstration of a real commitment to 'people first' programs...." and "Careful management of OPTEMPO..." p. 12-13.

³⁴ The task force led by MG David Ohle has constructed a rearrangement of Army career paths and promotion alternatives that if implemented can have a significant, positive impact on the culture.

Facilitating the Development of Advanced Performance:
Implications of the Study of Practical Intelligence

Richard K. Wagner

Department of Psychology

Florida State University

Library shelves are ready to burst from the weight of volume after volume of journals containing nearly a century's worth of test validity studies in which psychometric test A is shown to predict performance in setting B with modest accuracy. Despite this mass of information that has accumulated over the years from validity studies, an important gap in our knowledge remains: How can we predict and facilitate the development of advanced levels of performance?

The reason why existing prediction studies have so little to say in answer to this question is that the vast majority of studies have had initial level of performance as the criterion to be predicted. Among the most common criteria to be predicted are first-year grades in college, scores from an initial training experience, or supervisor ratings of relatively junior and inexperienced employees. Participants in most of these studies have had five or fewer years of experience on average. The reason why existing training studies have so little to say about how to facilitate the development of superior levels of performance is again, that most of the training studies have addressed the problem of how to facilitate initial levels of competency.

Of course, understanding how to select and train individuals for initial levels of competency is important. Everyone passes through the stage of initial level of competence, and only smaller numbers of individuals continue to develop to advanced levels of competence. However, in both the prediction and training literatures, there is a paucity of well-designed studies, particularly longitudinal ones, that extend beyond initial levels of performance. The limitation that most of what we know comes from the study of initial levels of performance turns out to be crucial for at least two reasons: The highly skewed distribution of productivity and the fact that what predicts initial performance is insufficient for predicting advanced performance.

Comments may be addressed to rkwagner@psy.fsu.edu or to the author at the Department of Psychology, Florida State University, Tallahassee, Florida, 32306-1270.

Highly Skewed Distribution of Productivity

The distribution of productivity becomes highly skewed with experience. What this means is that a relatively small number of top performers contributes a large portion of overall productivity. Consider several examples from a wide range of domains.

In the domain of classical music composition, classical composers have numbered in the thousands. Yet only 250 account for all pieces regularly performed in concert or recital halls. Of these, the top 36 composers account for three-fourths of the works performed. The top 16 composers account for one-half of the works performed. The top 10 composers account for 40 percent of compositions that have been deemed masterworks. Finally, the top 3 composers (Mozart, Beethoven, and Bach) account for 20 percent of the masterworks.

The highly skewed nature of the distribution of productivity is not limited to esoteric domains such as classical composition. Dennis (1955) examined the distribution of productivity in seven fields: Authors of books in the Library of Congress as of 1942; contributors to the scientific literature on gerontology and geriatrics; North American geology from 1929-39; publications on infantile paralysis through 1944; entries in Chemical Abstracts from 1937-47; contributions to linguistics from 1939-1947; and contributors to 18th century secular music. The results were that across these seven fields, the top 10 percent of contributors produced 50 percent of all work.

Dennis (1954) also examined the distribution of productivity in the field of psychology. Here again, the top 10 percent of contributors produced 40 percent of all work, and the bottom 50 percent contributed only 15 percent of all work. More recent data confirm this pattern of results. A graduate student and I have begun a preliminary review of scientific productivity in terms of number of publications and citation counts for scholars in the fields of psychology and mathematics. Citation count refers to the number of times an article or a book has been cited as a reference in another article or book. It measures the impact of a scholar's work on the field, and is viewed as the best single indicator of performance in scholarship. We have examined data from the year in which the Ph.D. was obtained through 20 years of career experience. In both fields, the median number of citations annually is less than 1. This means that the work of the typical scholar will not be cited by anyone else in a given year. However, a small number of individuals in our expanding database have annual citation rates exceeding 100, *a difference of two orders of magnitude in impact!*

The skewed distribution of productivity is well described by Price's law. Price's law states that half of all contributions are made by the square root of the number of contributors. For example, if 16 people at an identical level of authority were working on a task, 4 of them would contribute half of the work leading to task completion. Price's law provides a surprisingly good fit to existing data. In Mole's analysis of classical composers, 250 composers contribute to the repertoire. According to Price's law, the square root of 250, or 15.8 composers ought to account for half of the work performed. The actual number from Mole's data was 16. Dennis found that the top 20 authors in a field accounted for 53 percent of all catalogue listings, close to the prediction of Price's law that 14 authors would account for 50 percent of all catalogue listings.

Do Predictors of Initial Levels of Performance Predict Advanced Levels of Performance?

Turning to the issue of differences between what predicts initial performance and what predicts expert performance, Hulin, Henry, and Noon (1990) carried out a meta-analysis of validity studies. The issue their analysis addressed was the effect on the size of validity coefficient of the time interval between the test and criterion performance. The predictors included in the studies ranged from IQ test scores to measures of physical coordination. The domains from which criterion variables were available ranged from grades in college and graduate school, athletic performance, and job performance. The main result of interest was that from initial performance to final performance, the average change in validity coefficient was a decrement of .6, after correction for range restriction and unreliability. In other words, *IQ test scores and other predictors of initial levels of performance were substantially less predictive of later levels of performance.*

What accounts for the decline in predictive validity from initial to higher levels of performance is unclear. Part of the answer may be that with learning, task performance changes from an initial resource-dependent, controlled processing to an increasingly resource independent, automatic processing (Ackerman, 1987; Anderson, 1982; Salthouse, 1991). Part of the answer may be that the decline of validity coefficients reflects variability in training and practice undergone by individuals over time.

The meta-analysis of Hulin et al. (1990) extended measures of criterion performance beyond initial levels of performance, but did not extend to the development of advanced or even world-class levels of performance. Understanding the acquisition of superior levels of performance is of interest for both theoretical and practical reasons. Theoretical interest centers on the question of the extent to which knowledge about the mechanisms responsible for the acquisition of extraordinary levels of performance has implications for the more common acquisition of ordinary levels of performance. The practical importance of the study of superior performance derives from the fact previously discussed that in any domain, a relatively small proportion of superior performers accounts for a majority of the output. What do we know then about the acquisition of advanced or even world-class levels of performance?

Lessons from Legendary Performers

The 10-year rule. Despite popular folk accounts to the contrary, Simon and Chase's (1973) observation that no one attains the level of grandmaster in chess with less than a decade of intense preparation has proven to be true for other domains of expertise as well. Bobby Fischer, regarded as perhaps the best example of a modern prodigy at chess, required at least nine years of preparation before becoming a grandmaster (Krogius, 1976). Eminent composers who produced distinguished work as young as their early twenties had begun training in music roughly 15 years previously (Hayes, 1981). Similar results have been reported from the study of performance musicians (Sosniak, 1985), science and business (Simonton, 1988), tennis (Monsaas, 1985) and running

(Wallingford, 1975) (for additional examples, see Bloom, 1985 and Ericsson, Krampe, & Tesch-Romer, 1993).

The fact that at least a decade of intense, sustained training is required for achieving a world-class level of performance has implications that extend well beyond the study of expert performance per se. Were it the case that world class performers were freaks of nature whose achievements shortly after birth surpassed what 99% of us could hope to accomplish in our lifetime, there would seem to be few if any implications for the acquisition of more ordinary levels of performance. But it appears to be the case that experts require years of hard work involving a more intense and sustained application of the identical mechanisms of acquisition that result in the attainment of more ordinary levels of performance (Wagner & Stanovich, 1996).

What Does it Take Beyond a Decade of Experience?

A decade of mere experience is not sufficient for the attainment of world-class levels of performance. In fact, many individuals show little growth in performance after the initial year or two of experience. For the majority of individuals, ten years of experience is more like one year of experience repeated ten times. If mere experience is not enough, what then does it take to achieve advanced levels of performance?

Practical intelligence. When one leaves the classroom and enters a career pursuit, the nature of the learning changes in important ways. The knowledge that must be acquired now is informal as opposed to the formal knowledge conveyed in the classroom. Relatively little direct instruction takes place, rather the learning task becomes one of acquiring tacit as opposed to explicit knowledge from one's own experience and that of others.

Practical intelligence refers to the ability to acquire implicit knowledge from experience. It isn't possible to train every aspect of performance, particularly in complex domains. Successful individuals are able to profit from their own experience as well as from their observations of the experiences of others. These types of skills are not represented on traditional IQ tests, but have been the focus of efforts to develop and measure the construct of practical intelligence or common sense.

Neisser (1976) was one of the first modern psychologists to call attention to a distinction between the "academic intelligence" type tasks found in the classroom and on IQ tests, and the type of tasks found in the everyday world that require a more practical kind of intelligence. In the past decade, practical intelligence has been the focus of a growing number of studies carried out in a wide range of settings and cultures. Summaries of various parts of this literature have been provided by Ceci (1990), Rogoff and Lave (1984), Scribner and Cole (1981), Sternberg (1985), Sternberg and Frensch (1991), Sternberg and Wagner (1986, 1994), Sternberg, Wagner, and Okagaki (1991), and Voss, Perkins, and Segal (1991). Measures of practical intelligence relevant to areas such as business management, sales, and academic psychology predict job performance independently of general cognitive ability and common personality inventories (Sternberg et al., 1995; Wagner, 1987, 1994).

Deliberate training. Typically, the type of training that results in world-class performance is a coached regime of intense and effortful practice activities that have been selected with the goal of improving current level of performance (Ericsson, Krampe, & Tesch-Romer, 1993). A live coach may be optional for some domains provided an alternate means of getting feedback about the effects of one's training activities on one's performance is available (Charness, Krampe, & Mayr, 1996). The training is intense, effortful, and typically not as enjoyable as the actual performance.

Resource intensive. World-class performers typically begin their training in childhood, supported and encouraged by parents. The expenses are considerable, involving paying for a coach and transporting children to regional and perhaps national competitions. It may ultimately be necessary to move to be in close proximity with the best coaches and the highest level of competition. In addition to money, the acquisition of expertise is costly in terms of time required. We may dream of attaining a world-class level of performance in some domain, but few of us will be able to add the several hours of daily intense training required to already crowded days.

Motivation and interest. Because the kind of practice required to achieve expertise is effortful, intensive, and directed toward the goal of improving level of performance, it often is not enjoyable. Players training to high-level competitive tennis spend hours performing footwork drills, developing their physical conditioning, and practicing individual strokes such as the serve for thousands of repetitions each week. None of these activities is as potentially enjoyable or rewarding as the actual competition. For every individual who endures, countless others will burn out and cease training.

In addition, unlike the well-defined learning tasks that are given students in schools, continued learning on the job is in some sense more optional. Typically individuals survive just fine in many organizations by performing at a competent level year after year. Electing to work at continued development is not likely to happen unless an individual is highly motivated to do so.

What Kind of Studies is of Critical Importance?

If we are to inform the Army on how best to cultivate highly experienced leaders, it is vital that carry out studies that combine what we know about individual differences in performance with long-term learning. We have begun to uncover some basic principles of what appears to be required to achieve world-class levels of performance, principles that are general to across domains rather than domain-specific. What is required is both retrospective and prospective longitudinal studies of long-term achievement that allows us to examine what is effective training over the long haul and for whom.

A powerful new methodology called growth curve modeling turns out to be ideally suited for examining the development of advanced levels of performance in the context of variables that capture (a) characteristics of effective training, (b) characteristics of individuals that make them differentially able to profit from training, and (c) potential

interactions between characteristics of training and individuals (i.e., what works best for whom).

Growth curve modeling. Fully capturing the acquisition of performance in a domain over a considerable period of time requires a relatively large number of repeated observations. Growth curve modeling (also known as multi-level analysis or hierarchical linear modeling) provides a way to analyze longitudinal data (both retrospective and prospective) that becomes more feasible and flexible as the number of repeated observations exceeds three.

Traditionally, attempts to quantify and analyze growth have relied on only two measurement points (i.e., pretest and posttest), with growth represented by a difference score or a residual change score. Although such scores provide unbiased estimates of growth, they often suffer from poor reliability for individual difference analyses and provide little information about the nature of growth (Rogosa, Brandt, & Zimowski, 1982; Willett, 1988), both of which are detrimental to understanding the acquisition of expert performance. Similar and related problems have plagued the aptitude-treatment interaction literature (Cronbach & Snow, 1977).

Growth curve modeling has proven to be a powerful new method for quantifying and analyzing growth that largely overcomes the problems associated with difference scores and residual change scores (Bryk & Raudenbush, 1987; Rogosa, Brandt, & Zimowski, 1982; Willett, 1988; Willett & Sayer, 1994). Instead of having only two measurement points, multiple waves of data are collected. Three or more waves are sufficient for fitting linear growth curve models; four or more waves are sufficient for fitting nonlinear models.

Just as variability in observed scores obtained on a single occasion can be divided into true score variance and measurement error, growth in observed performance can be divided into true growth (i.e., true score change) and measurement error. Estimates of true growth parameters, their variances, and their reliabilities can be obtained.

Conceptually, growth curve modeling involves two levels of analysis. At the within-person level, growth parameters are calculated for each subject by regressing performance on an algebraic function of time, training trials, or some other relevant index. At the between-person level, individual differences in growth parameters over subjects are analyzed, and attempts are made to account for these individual differences by examining potential correlates of growth. Computationally, both levels of analysis proceed simultaneously, yielding more reliable estimates of growth parameters than would be obtained by performing separate ordinary least-squared regressions to solve with within-person and between-person models.

In our preliminary studies of career performance in academic psychology and mathematics, we are using growth curve modeling to capture changes in the performance of individuals over time. We are finding that performance over time is well captured by a curvilinear model in which performance accelerates during the initial stages of a career and then plateaus or even declines later on. Large and reliable individual differences in performance are found. In future work, we hope to be able to predict long-term career

development with variables that represent characteristics of the individuals and the training and learning experiences they participate in.

Conclusions

Beginning the search for determinants of the acquisition of superior performance in complex domains is likely to involve efforts directed at several fronts. These include expanding the set of predictor variables, expanding the time frame of performance assessment, and investing in training research (Wagner, 1997).

Expanding the Set of Predictors

After decades of research that include major efforts in the 1980s and 1990s, it is unlikely that refinements in cognitive ability tests will result in substantial gains in validity (Schmidt, 1994) for predicting initial levels of performance in any domain. However, expanding the set of predictor variables to include variables relevant to the long-term acquisition of superior levels of performance is likely to be fruitful. Promising individual difference predictors include measures of practical intelligence and motivation.

Expanding the Time Frame of Performance Assessment

Despite 60 years of effort, the "criterion problem" of deciding how best to measure performance remains among the most pernicious problems facing psychologists (Gottfredson, 1991). At issue are the method or format of the assessment and also the content of what is assessed. It is clear that a top priority is expanding the time frame of the assessment of performance.

Investing in Training Research

Although important issues remain to be studied in the area of selection, a greater pay-off is likely from advances in our understanding of training. In the domains of employment and education, very few individuals receive frequent feedback and training activities designed to improve their performance. In employment, most of us receive only yearly performance reviews, the majority of which are exceedingly general. Most of the learning that results in improved performance happens informally as a result of learning from one's own experience and that of others (Wagner, 1991).

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Developing Swift Trust in Temporary Teams: Challenges for Military Leadership in the Age Of Mediated Communication

Suzanne Weisband
Management Information Systems
College of Business and Public Administration
University of Arizona
Tucson, AZ 85721
voice: 520-621-8303
fax: 520-621-2433
sweisband@bpa.arizona.edu

Abstract

Recent attention to the virtual organization suggests that temporary, distributed work groups and global teams are becoming increasingly common to all organizations, including the military. Temporary teams are groups of people who must work closely together, learn from each other, and accomplish specific goals, all within a compressed period of time. For temporary teams who conduct their interactions over computer networks, a major problem is converting the skills and efforts of individuals into collective, interdependent goals without the benefit of face-to-face contact. Based on evidence collected in longitudinal field studies of leaders in temporary electronic teams, this paper describes various roles that leaders perform in their efforts to get work done in a short period of time. Particular attention is paid to the leadership roles that allow teams to develop collective knowledge and maintain trust in these settings.

Developing Collective Knowledge in Temporary Teams: Challenges for Military Leadership in the Age of Mediated Communication

The information age has spawned a host of new technologies that are revolutionizing communication patterns in modern organizations and society itself, bringing with them both opportunities and challenges for the exercise of leadership in military and other organizations. By bridging time and space and packaging information in new ways, such innovations as electronic mail, videophones, faxes, computerized group support systems, electronic whiteboards, multimedia, virtual reality, and computer agents are enabling instantaneous distributed communication, the creation of virtual teams, and the exchange of information in ways not imagined just a few years ago.

With these promising developments, however, have come new demands for military organizations and their leaders. It means that military teams must work closely together, learn from each other, and accomplish specific goals, all within a compressed period of time. It means they must be able to operate autonomously. It means communication with headquarters and other units will be minimized, and unit commanders must be able to execute their orders, or the intent of their orders, with confidence that these self-contained, autonomous units can perform effectively. Add to this the complexity of working with diversly skilled people on a critical task over a limited period of time while using computer communication technologies, and it is easy to see how such groups challenge our conventional understandings of effective organization.

Distributed work groups and global teams are becoming increasingly common to all organizations, including the military. In theory, computer-mediated technologies can facilitate the movement and coordination of distributed personnel and material resources. They can also enable senior officers far from the battlefield to substitute their judgments for that of ranking military personnel on the scene. The hope is that information technologies will provide quick and effective communication access to division leaders and other officers, and that teams will become increasingly distributed, flexible, and responsive to environmental events. Although fast, inexpensive, and effective human-to-human communication in the military seems warranted, the full range of payoffs will come from understanding how these electronic teams convert the individual skills and efforts of people in remote locations into collective task outcomes in short periods of time.

In a series of studies my colleague and I conducted on leadership in distant teams, we examined the communication practices of virtual teams to provide a theoretical and descriptive explanation of what leaders in virtual teams do to produce collective knowledge and maintain trust as a foundation for accomplishing the team's mission

effectively and on time. Given the compressed time in which army units must gather information and carry out their tasks, temporary systems have many of the characteristics found in the military, as well as in virtual teams. The next section describes the nature of temporary systems. To address the implications of leadership in these virtual temporary teams, I begin with an understanding of how temporary teams conduct their work, followed by a discussion of the importance of continuous interaction among team members and leaders. From our research findings, I discuss the leadership roles that allowed distant teams to produce collective knowledge quickly and perform effectively. Implications for leadership in virtual teams are then drawn.

Temporary Systems

The rise of these temporary systems in organizations is due in part to the geographic distribution of skills and knowledge, the demands of fast-cycle times and joint decision-making, and the advent of electronic communications. The characteristics of temporary systems include:

1. Team members with diverse skills are asked to use expertise they already possess.
2. Team members have limited history working together.
3. Team members have limited prospects of working together again in the future.
4. Tasks are often complex and involve interdependent work.
5. Tasks have specific goals that must be accomplished within a deadline.
6. Tasks are consequential.
7. Continuous interrelating is required to produce an outcome.

Examples of temporary systems include crises and disaster teams (Perrow, 1984; Weick, 1993), cockpit crews in planes (Weiner, Kanki, & Helmreich, 1993), fire-fighting crews (e.g., Klein, 1993), and film crews (Bach 1985, Kawin 1992). A major problem for these teams is converting the individual skills and efforts of people they hardly know, and may never meet again, into interdependent work products in short periods of time. To accomplish work in this way, people must reduce their uncertainty about one another through operations that resemble trust (Meyerson, Weick and Kramer, 1996). That is, to be successful, temporary teams must quickly develop and maintain trust so that collective knowledge and diverse skills can be utilized in continuous interaction. (Goodman and Goodman, 1976).

Swift Trust and Temporary Teams

Most models of interpersonal trust development assume that trust develops over time. Trust, as manifested through openness, reciprocal disclosure, and familiarity, requires repeated interactions and a variety of shared experiences and circumstances. This

history of interactions and shared experiences then serves to confirm the validity of trust and shapes future interactions. In this way, people learn over time (1) the rewards and punishments for trusting behavior, (2) who to trust and how predictable people are in their trusting behavior, and (3) the shared beliefs and values of the group's collective identity.

Situations requiring swift trust do not allow for this incremental, gradual evolution based in increasing knowledge and information about others' behaviors. Since the temporary team must move forward quickly to accomplish goals, members must act swiftly as if trust were in place rather than waiting to see who can be trusted and who cannot. They must work continuously and consistently to maintain expectations of trust. Pre-existing or contextual factors may also help foster initial expectations of trust (Zand 1972). For example, in movie productions, trust may revolve around the reputation of the director or, in the case of military teams, trust may revolve around the mutual professional identification of other military team members.

Factors that Contribute to Swift Trust

To the extent that team members have developed sufficient trust, they will learn what is expected of them and be willing to carry out the work, express their own opinions, give feedback to others and ask for feedback on their own work, debate alternatives, figure out technical problems. For the military, trust means doing whatever is demanded at the moment, including self-sacrifice.

In order to develop swift trust, team members must communicate. Continuous interaction among team members is especially important under crises and time pressure. For example, in the Tenerife air disaster (Weick, 1990), the copilot of the KLM aircraft strongly suspected that another 747 airplane was on the takeoff runway directly in front of them when his own captain began takeoff without clearance. But the copilot said nothing about either suspicions or the illegal departure. How did this improbable failure (of a captain taking off without clearance, directly into the path of another 747) occur? Linguists who analyzed the conversations at Tenerife and in the crash of Air Florida flight 90 in Washington concluded that the copilots in both cases used "devises of mitigation" to soften the effects of their requests and suggestions.¹ It was found that the speech of subordinate crew members was much more likely to be mitigated than the speech of captains (O'Hare & Roscoe, 1990).

If a role system collapses among people for whom trust, honesty, and self-respect are underdeveloped, then they are on their own. And fear often swamps their resourcefulness. If however, a role system collapses among people where trust,

¹ A mitigated instruction might be phrased as a question or hedged with qualifications such as "would" or "could."

honesty, and self-respect are more fully developed, then new options...are created. When a formal structure collapses, there is no leader, no roles, no routines, no sense (Weick, 1993, p.643).

Leaders can have the greatest impact on team functioning before people get into a tight spot. Excellent leaders can build trust by spending more time team building when the team first forms (Ginnett, 1993). Team building comes from leaders who model norms that expect safety, effective communication, and cooperation from everyone. For example, excellent aircraft captains treated the flight attendants, gate personnel, and air traffic controllers as members of the total flight crew. Less-excellent captains drew boundaries around the people in the cockpit and separated them from everyone else (Ginnett, 1993). Excellent crews expect one another to carry out any of these exchanges: "(1) I need to talk to you; (2) I listen to you; (3) I need you to talk to me; or even (4) I expect you to talk to me" (Ginnett, 1993, p.88). Thus, the leader's ability to engage the crew in these kinds of interactions, the larger their collective knowledge base will be. Substantive discussions will lead to team learning, reflection and refinement, and improved evaluations of their work. As Bass (1990: 637) put it, "Groups that are unable to interact easily or that do not have the formal or informal structure that enables quick reactions are likely to experience stress," and degrade performance.

Communication and Leadership in the Army

In the Army, communication is based on formal structures: According to a recent draft of the Army's Leadership Doctrine (FM 22-100), leaders issue orders and instructions through the chain of command, which are then conveyed to the unit. The unit then carries information back up the chain, informing leaders about how things are going, what the problems are, and requesting clarification and help. Leaders in turn keep their people informed and render assistance. Figure 1 is an example of how information may be communicated up and down the chain of command. In this example, leaders can be found outside the unit, bordering the unit, and within the unit; leaders can communicate with other leaders laterally, as well as vertically. If leaders and their units rely on the chain of command to communicate information through different levels of the hierarchy, the challenge for leadership becomes determining how to create a relationship of mutual trust and community when communication is mediated. Can distributed, electronic teams achieve trust quickly? How do leaders move the team forward, perform their missions, and achieve trust among members who do not see each other? Our study was designed to answer these and other questions related to temporary virtual teams.

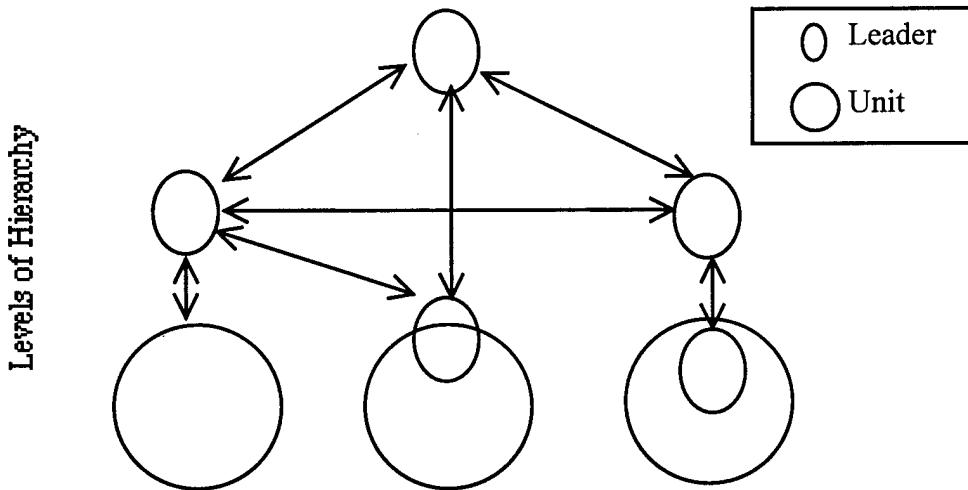


Figure 1. Communications and the Chain of Command

In the way we think of virtual temporary teams, face-to-face interaction is rarely possible and electronic communication using a variety of asynchronous or synchronous utilities such as distribution lists, email or computer conferencing systems becomes the norm. This difference in form of interaction raises the important question of what continuous virtual interaction means. Does it mean, for example, hourly communication, daily communication, or routine communication relative to the amount of time involved? Does it mean equal participation from all team members in terms of amount, quality or frequency? Does it mean consistent team interaction to a particular topic, regardless of who is contributing or does it mean consistent interaction only at deadlines or crises?

Defining Trust in Electronic Interactions

In an effort to analyze strategies for interaction, Iacono and Weisband (1997) focused on initiations and responses. Initiating an interaction by making a request or proposal are strategies for interaction. They make one's own preferences public and invite others to acknowledge them. To initiate interactions requires trust. It places the initiator in a position of vulnerability. The proposal may be rejected or ignored in favor of other proposals. Public refusals, denials and acceptances also carry some social risks. Status and reputations can be determined from public interactions and their responses. Each individual initiation, then, is an enactment of swift trust, contributing to the collective perception that trust is reasonable, inspiring more trust and more initiations from other members of the group.

Generating the relevant responses also indicates trust. A response indicates to the initiator (and everyone involved in the interaction) that the receiver has done his or her obligatory part. Consequently, the making of responses signals and inspires trust that the

group is responsible and skillful enough to handle the uncertainties currently in front of them. Those willing to risk initiating action can trust that they will receive responses and that their interactions will be appreciated, whether in agreement or disagreement, but not in silence. Those making responses contribute to the perception that uncertainty is being decreased and that the people can be successful in achieving their goals.

Each initiation and response contributes to and builds trust, increasing as it is used. Swift trust depends entirely on the swift and successive interplay of initiations and responses. The timing and pace of these synchronic interactions depend entirely on what the group itself considers appropriate for working to its deadlines. But the more frequent the interactions, the more dense the social ties and the more vital is the social life of an interacting team.

Research Context

We studied three different configurations of virtual teams over three years. Figure 2 shows, for each year, the number and size of teams, the kinds of communication technology they used for the project, the way the teams were organized, and the number of different geographic sites involved in the project. For example, in Year 2, there were 23 four-person self-organizing teams from three different sites who worked together using computer conference, email, and videoconferencing to perform their task. Our goal was to simulate work in temporary teams and to require the development and use of swift trust in order to be successful. The task was highly interdependent and required team interactions to achieve objectives. For this paper, I will focus on our findings of leadership in these virtual teams and discuss the implications of effective leadership.

Project Setting

For the study in Year 3, graduate and undergraduate students in two geographically distant U.S. universities participated in virtual team projects developed for their MIS classes on the iSocial Issues of Computing. While the classes at the two universities differed in a number of ways, the project was designed to simulate work in temporary virtual teams: (1) The project lasted 4 weeks; (2) vulnerability was high as the task was highly interdependent and required team interactions to achieve objectives; and (3) uncertainty was high as everyone was a stranger and all communications were to be conducted using some form of mediated communication. To enable fair participation across the two universities, the project started and stopped on the same dates, students were given the same project instructions, requirements and deadlines. Teams were comprised of four members, where one of the members was a graduate student assigned as the team leader.

Year	No. of Teams	Size of Teams	Technology	Organization
1	14	3	Email & Distribution List (DL)	Self-Organizing
2	23	4	Email DL & Video Conferencing	Self-Organizing
3	15	4	Web Conferencing & Email DL	Leaders

Figure 2. Three Year Study of Virtual Teams

The teams used a web conferencing system to get to know each other. Then, once they had formed a team, they constructed their own web team, or used an email distribution list. They were encouraged to log in and send email every day of the multi-week project. But due to the asynchronous nature of the medium and the short duration of the project, we stressed the importance of frequent contact with the group, and that students work as swiftly as possible.

The project consisted of a 5-page policy paper on some topic related to the social issues of computing. It included: (1) an introduction or background discussion of the issue and why it was controversial; (2) the current (if any) private or public policies in use on this issue; (3) the articulation of five guiding principles on which they would ground the policy formulation; and (4) the team's recommended policy framework and why they considered this framework to be a good one. In discussing their policy, team members could also say something about how such a policy might be implemented.

All professors graded the project papers separately and then discussed together (via telephone conference) the final grade for the paper. All team members received the same initial grade for the paper. In addition, team members evaluated each other's contribution to the project and each professor calculated the frequency, number, and quality of email posts, and presentations to their respective classrooms for each individual. Individual grades were then raised or lowered from the initial paper grade depending on the individual's participation to the team project. One video conference was held on the last day of the project.

Measures

We collected data from three main sources. (1) Pre- and post-project questionnaires, measuring demographics, school performance, computer access, team and electronic

communication experience, and perceptions of leadership. (2) Electronic messages from the web conference and email distribution lists. We analyzed these messages by coding embedded initiations, responses, and monologues. (3) Performance measures.

Performance was the extent of team learning as mutually determined by the professors. This team grade reflects the extent to which the team jointly researched, analyzed and developed a new understanding of a computerization controversy. Although the instructors monitored the progress of the project and responded to questions and problems, all data were collected and coded after course completion.

Results

Interaction measures

There were a total of six categories that we used to measure interactions. They include getting together, work process, monitoring, work content, technical, and social support. For each category, we divided comments into initiations and responses, and then calculated the proportions of initiations to requests. Overall, Work Process initiations and responses were positively correlated with team performance ($r_{IS} = .51$ and $.48$, $p < .10$, respectively). Similarly, Work Content initiations and responses were strongly related to how well the team performed on the final project ($r_{IS} = .67$ and $.61$, $p < .01$ and $<.05$, respectively), as were Total initiations and responses ($r_{IS} = .59$ and $.55$, $p < .05$, respectively). These three variables also reveal significant mean differences among high- and low-scoring teams suggesting that high performing teams generated more initiations and responses about how to accomplish the work (Work Process) and what the content of the work should be (Work Content) than did teams who did not perform very well. Interestingly, high performing teams seemed to also find time to have fun. Even though there were very few Social Support initiations and responses overall, the majority of them occurred in high performing teams.

Interaction measures over time

In Figure 3, we plot amount of interaction as indicated by average total email messages by day for two categories of teams, high-performing and low-performing. While the peaks and valleys are somewhat similar, there are several important differences. High-performing teams, on the average, had significantly higher team interactivity throughout the life span of the project than did the low-performing teams. These differences are particularly salient at the beginning and end of the project, indicating earlier high levels of interactivity to find partners and quickly form teams and then again high interactivity during the final completion of the project. While the mid-point was the peak for initiations for both types of teams, the high-

performing teams maintained these high levels of interactivity as the project deadline approached while the low-performing teams' interactivity declined.

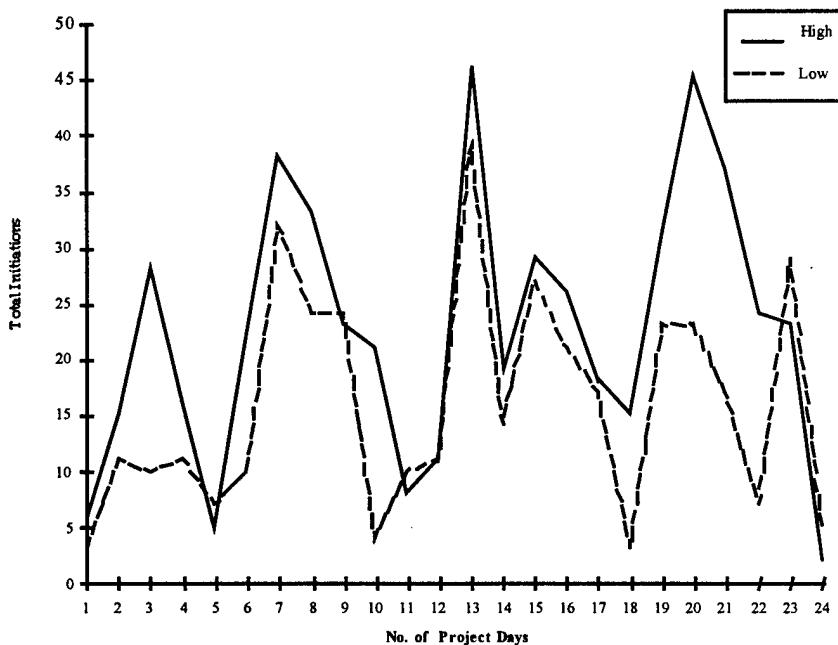


Figure 3. Total initiations per day of the project

In Figures 4a and 4b, the three most revealing trust categories were combined to show the cycles of initiations over time for the high- and low-performing teams. In Figure 4a, there were two peaks during the first phase (day 8). High-performing teams began by generating Getting Together initiations on day 3, where they also initiated Work Process and Work Content messages. In contrast, low-performing teams peaked with Getting Together initiations on the day before the first deadline (day 7). In fact, one team was generating Getting Together initiations during the second phase of the project (day 14). Work Process initiations did not start up until day 6 of the project, and Work Content began three days after that.

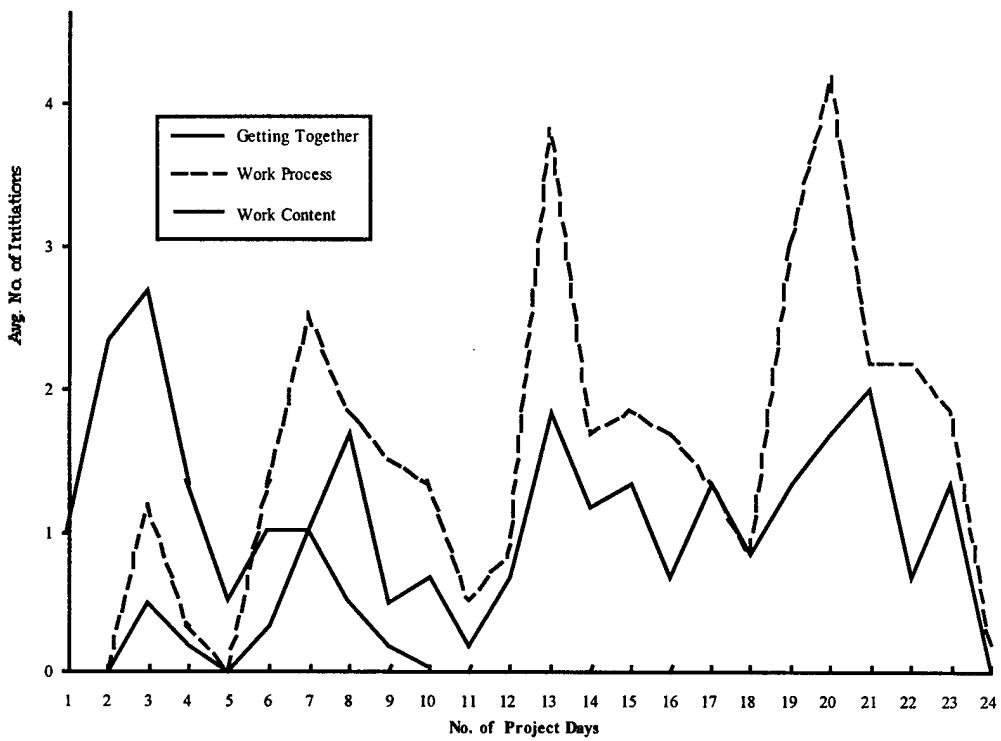


Figure 4a. High-performing teams by trust categories

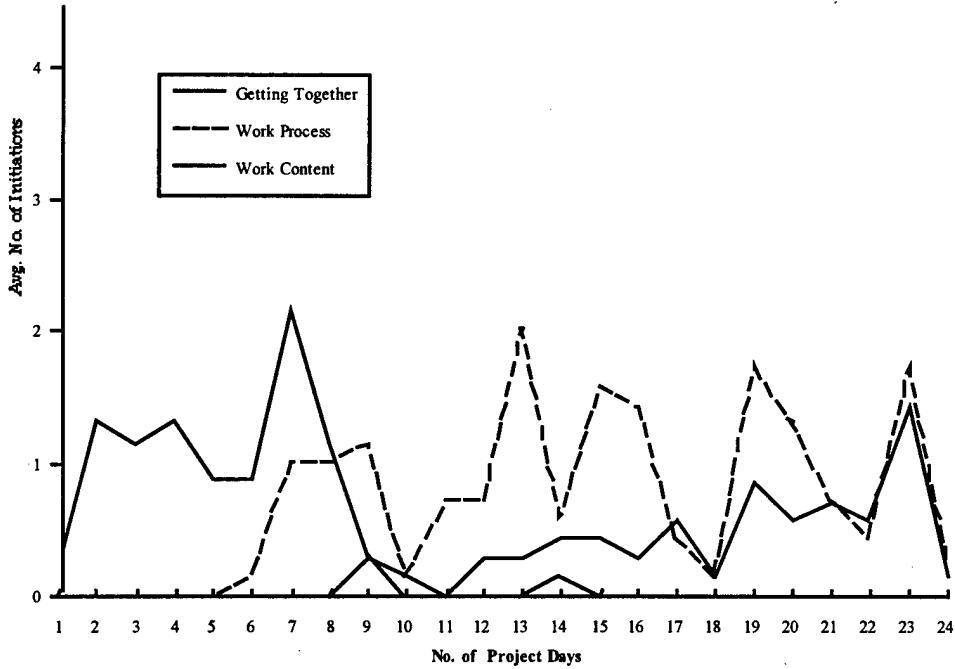


Figure 4b. Low performing teams by trust categories

The dynamics of initiation cycles over time varied considerably for high- and low-performing teams. Comparing Figures 4a and 4b, we see that, on average, high-performing teams' initiations escalated over time, whereas the cycles of initiations for

low-performing teams reached a plateau and decreased as the project progresses. In Figure 4a, the dips on the weekends for high-performing teams were less deep as the project progressed and the peaks were higher across all categories until three days before the project ended when all initiations begin to taper off. In contrast, Work Process initiations for low-performing teams contained sharp dips and rises and Work Content initiations did not peak until the day before the project was due (see Figure 4b). As a result, low-performing teams found themselves fighting to make the deadlines (days 15 and 24) and not sustaining their efforts. In general, there was less team communication and less involvement over time.

Leadership Roles

Our second level of analysis examined the interactions and roles of the leaders. We observed six leadership roles that occurred in various forms in each of the teams we studied. Figure 5 presents the virtual leadership roles and observed behaviors. There were three roles that focused on the team structure, and three roles challenged that structure and focused on innovation, or new knowledge. Leaders who were most effective in leading their team to high performance were those that spanned the boundary between the team and the external environment. These “boundary spanners” participated in all of the observed leader behaviors; they set up the team structure for how the work would be conducted, monitored that structure, and took part in discussions on the content of that work. They also engaged in social interactions, motivating the team to work together as a cohesive unit.

Some teams performed well, but the leader received low evaluations by the team. Leaders in these teams did not perform the team liaison role, making it difficult for the team to understand the task requirements. Poorly evaluated leaders often did not take initiative, tending to react to what the team members had done. Sometimes these leaders would exclude a member of the team to improve performance. Certainly, if the end justified the means, then leaders who “get the job done” may be effective, but if leaders want to build trust, then excluding team members may create conflict rather than cohesion.

Leaders were also responsible for a team’s poor performance. In general, poor leaders did not initiate structure, or monitor the team’s progress. Often, they were absent or silent from team interactions. Silence in the leader was interpreted as “unwilling to work,” even though it could have been due to technical difficulties (Cramton, 1997). In the end, poor leaders either (1) led the team from “above” by giving orders without engaging in the content of the work, or (2) failed to lead the team at all, preferring to be

just another team member rather than take on the added responsibility of leading the team.

Leadership Roles	Observed Leadership Behaviors
	<u>Focus on Structure:</u>
Team structure initiator	Initiates prototype game plans, division of labor, etc., and attaches names to various roles; makes specific what has to be done, the process they will be going through, etc. <i>The ability to structure the team process is a critical aspect to speed and to the ability to get work done on time.</i>
Team performance monitor	Monitors that people are doing their assignments on time; puts pressure on specific people and the team to make decisions and perform the plan; gets people in the habit of self monitoring (e.g., offering their upcoming schedules, expected absences, plans for doing research and delivering their sections, etc.) <i>Monitoring is essential to speed.</i>
Team liaison	Makes sure that the work done by the team fits the requirements; goes to the professors to get extensions, find out about specific do's and don'ts, etc. If no one does this, then the final product will not meet the goals of the project and will be perceived by the stakeholders to be of lower quality.
	<u>Focus on New Knowledge:</u>
New knowledge producer	Synthesizes, summarizes, and elaborates on what is known to date and what still is not known (usually in monologues). These monologues bring together the fragmented work of the team members and pushes the team to a new level of understanding. <i>This role is extremely important to the quality of their work.</i>
Social motivator	Engages in fun interactions, uses interesting and fun language; makes sure that everyone is included, reaches out to team members that are not participating; thanks people for doing good work, giving extra effort; etc. <i>The social role behaviors help reduce stress when they are in pressure situations and helps the team to perform better.</i>
Technical advisor	Receives questions and gives advice about how to use the various features of the communication channels available to them; makes sure that everyone is up and operating, knows how to make links, etc.; makes sure that everyone has everyone's correct email address, etc. The objective is to insure that the communication channels are all open and that no one is not communicating because of some technology knowledge barrier. <i>If an assigned leader gets too involved in this, they can neglect other important leader roles.</i>

Figure 5. Virtual leadership roles and behaviors

Implications

We found that continuous interaction is essential because it provides the opportunities for building and maintaining swift trust. As participants respond to others' initiatives, virtual interactivity rises, uncertainty is decreased and trust reinforced. This dynamic feeds new cycles of interactivity. It has been argued that in order to be successful, teams must develop and maintain productive, interpersonal working relationships. In our study, we found that both high levels of initiations and high levels of responses predicted team performance.

The other important conclusion we came to was that excellent leaders engaged their teams in multiple interactions. Leaders were crucial for providing teams the needed structure and collective knowledge necessary to move the team forward quickly and effectively.

The implications for virtual leadership in the Army are to consider ways of engaging team members in interaction. Given the Army's structure for communicating within the chain of command, it may mean that new team/leader configurations be considered. If the Army is going to take advantage of their distributed settings and rely on electronic communication, then leaders must be engaged at the boundary of the team. If the leader directs from above and at a distance, it will be difficult to interact closely, monitoring activities and challenging team members to be innovative. Virtual leaders need to be *ipresent*, if not physically than through continual communication. It is not enough to give orders and leave the rest to the team. Our studies have found that it is the interaction that is critical to success, and that team leaders who did not participate in the hard work, then sensemaking and communication dropped off, leaving the team to struggle on their own. In the end, teams without leaders had a harder time completing the project and teams with poor leaders performed poorly.

In conclusion, formal structures are important to all team activity, but learning how to break out of those structures in times of crises, to communicate effectively to all team members, is critical to team success. To extent that Army units become dependent on electronic communication for carrying out mission objectives, a careful understanding of the work involved in keeping the team together through computer networks is required. Technical problems and difficulties in managing the exchange of information may persist for some time to come. Success may depend on a leader's ability to manage people at a distance (Cramton, 1997). However, *one thing that we learned from our three years of investigating electronic teams is that it is possible to perform effectively from a distance, without the need for daily face-to-face interaction*. The work can be done quickly and effectively, but not easily. For that reason alone, it is worth continuing to investigate the implications of leadership in virtual teams.

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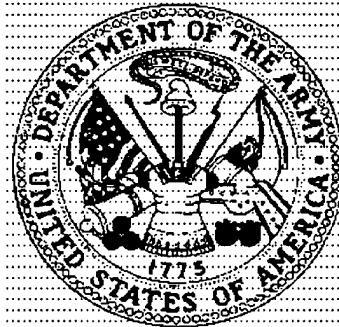
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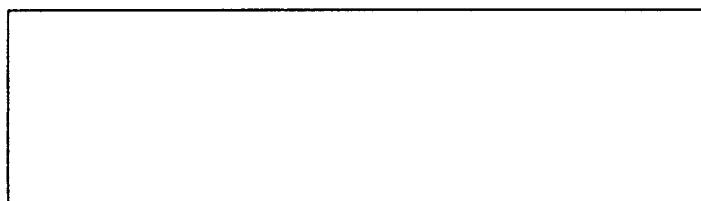
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ETHICAL LEADERSHIP: A LEADERSHIP FOR ALL SEASONS

**Prepared for the:
US Army Research Institute
Workshop on Human and Organizational
Issues
for the Army After Next**

**Prepared by:
COL K.L. Frey (ret)**



Introduction

The quality and depth of our leadership reflects itself in our relationships with our colleagues and our followers; we must be clear about our values because they reveal who we really are as leaders.¹

The Army After Next conjures up images of a “star wars” scenario with military forces operating in the multi-dimensional environment of the digitized battlefield. While the science fiction analogy still may seem implausible to some, no one can deny that the world has fundamentally changed since the end of the Cold War and that the implications for national security have been profound. Indeed, the decade of the 1990’s has been termed a paradigm shift in the course of history.

Introduced by historian and philosopher, the notion of a paradigm shift describes the idea that perceptions of truth change as a consequence of new realities.² In other words, a new frame of reference for understanding is born of conditions or developments that defy explanation in terms of previously accepted norms. The new realities of the 1990’s include:

- A new geopolitical order – the end of East-West, bi-polar world domination and the emergence of volatile, multi-polar, regional powers.
- A new business environment – transformation of national economies into international financial conglomerates fueled by an open, competitive, dynamic world market.
- New science and technology – the end of the Industrial Age and the dawning of the Information Age, enabled by lightening speed technological advances in communications and transportation.
- New enterprise – traditional, hierarchical organizational structures giving way to flatter, streamlined organizations.³

In terms of military power, these realities have wrought significant change in the US military. With the disintegration of the Soviet Union, the clear-cut East-West threat has dissolved into a far more complex and uncertain world situation. The National Security Strategy has changed from a policy of containment of communist expansion to a policy of engagement and enlargement.⁴ Indicative of this shift has been the increasing use of military power for stability and support

¹ Frances Hesselbein, Marshal Goldsmith & Richard Beckhard, editors, *The Leader of the Future: New Visions, Strategies, and Practices for the New Era*, 1996, p.193.

² Thomas Kuhn, *The Structure of Scientific Revolutions*, 2d Edition, 1970.

³ Don Tapscott & Art Caston, *Paradigm Shift: The New Promise of Information Technology*, 1993, pp. xii-xiii.

⁴ The White House, *A National Security Strategy of Engagement and Enlargement*, 1994, p. 1.

operations to volatile regions around the world such as the deployment of US forces to Bosnia. The end of the Cold War, new threats, new missions, the national budget deficit all have provided impetus for a decade of milestones including the National Performance Review and re-invention of government,⁵ the military drawdown and Commission on Roles and Missions of the Armed Forces,⁶ and the Army's own Force XXI Campaign.⁷ The outcome has been a transformed Army, revolutionized by advanced weapon systems, new operational concepts, revised training doctrine, equipment modernization, and re-engineered organizations.⁸

For the Army leader, the metamorphous an imposing future. Full-dimensional operations that entail scenarios across the entire spectrum of war will call upon leaders to be skilled in both the art and science of military warfare, capable of adjusting rapidly to temporal and spatial variations of extended battlespace.⁹ Military theorist predict that future battle will require multi-discipline versatility on the part of Army leaders rather than specialized functional concentration. As command and control becomes internetted and organizations flatten, leaders will be taxed by higher leader-to-led ratios and lightening speed decision cycles. Indeed, operating in a knowledge-based environment (as opposed to Cold War threat-based conditions) will be a formidable task.¹⁰

What of the human dimension, the human element in combat that causes soldiers to stand and fight, risking their individual safety for the collective welfare of their team? This social, psychological phenomenon generally referred to as unit cohesion is a powerful force, one in which leadership plays a central role. The role of the leader is one of influence, instilling values and incorporating the Army ethic into group norms.¹¹ Nonetheless, the prevailing theme among military theorist to date seems to be fixed on leader competence (e.g., the "how" of warfighting or "technical and tactical proficiency"). It could be interpreted that the soldier has become an extension of the modernized weapon system. Characterizations of Force XXI that state Force XXI is the Army's effort to harness "information-age capabilities; increased integration of service

⁵ Al Gore, Vice President of the United States, *Creating a Government that Works Better and Costs Less: Report of the National Performance Review*, 1993.

⁶ US Department of Defense, *Report of the Commission on Roles and Missions of the Armed Forces*, 1995.

⁷ Togo D. West, Secretary of the Army, & Gordon R. Sullivan, Chief of Staff of the Army, *Force XXI: America's Army of the 21 Century*, 1995.

⁸ William W. Hartzog, Commander, Training and Doctrine Command, *Land Combat in the 21st Century*, 1995, pp. 2-3.

⁹ US Department of the Army, *Training and Doctrine Command Pamphlet 525-5: Force XXI Operations*, 1994, pp. 2-6.

¹⁰ US Department of the Army (DA), *DA Pamphlet 100-XX (Final Draft): Force XXI Institutional Force Redesign*, 1996, pp.13-14.

¹¹ William Darryl Henderson, *Cohesion: The Human Element in Combat*, 1985, p.11.

components into an effective battle team [of] more lethal, survivable, and agile systems; and more capable soldiers and leaders"¹² typify the competency orientation.

Conversely, this paper aims to promote the human dimension of leadership in the 21st Century, suggesting that competency, **character, and compassion** should be the imperatives for leaders of the Army After Next. The words of General Creighton W. Abrams, a former Chief of Staff of the Army, are renown:

People are not in the Army, people are the Army...By people I do not mean personnel....I mean living, breathing, serving human beings....They are the heart of our preparedness... the spirit of our soldiers....It is the spirit that gives the Army... life. Without it we cannot succeed.¹³

In that vein, the "why" of warfighting or human motivations are the focal point of the discussion that follows. The thesis, then, is that Army core values are the bedrock of leadership and that ethical leadership is the root source of positive people skills for our leaders of the Army After Next.

Significantly, the winds of change have altered, not only the geo-political landscape, but also the socio-economic. Workforce 2000,¹⁴ adds a compelling human factor to the shaping of the Army After Next. The manning of the Army After Next necessarily will reflect the ongoing demographic shift in the American labor pool. By the year 2000, 70 percent of new entrants into the labor force will be minorities and women. Native-born white males will comprise only 15 percent of new workers.¹⁵ Unquestionably, cultural diversity of this magnitude will have a substantial impact on the Army After Next, and Army leaders will be confronted by human relations challenges as acute as any other dynamic associated with this new era called the Information Age.

¹² William W. Hartzog, Commander, Training and Doctrine Command, *Land Combat in the 21st Century*, 1995, p. 2.

¹³ Harris Hollis, Lieutenant General, "The Heart and Mind Of Creighton Abrams," *Military Review*, April 1995, p.63.

¹⁴ William B. Johnston & Arnold H. Packer, *Workforce 2000: Work and Workers for the 21st Century*, 1987.

¹⁵ Harvey Kahalas & Kathleen Suchon, "Ethnic Diversity, Global Competition and the American Work force," *The Aspen Institute Quarterly*, Autumn 1994, p. 112.

Ethical Leadership

While futurist thinking in military circles has centered on the need for leaders to have highly developed cognitive skills to process information, conceptualize and solve complex problems, in the private sector, much has been written on the subject of ethical leadership as a model for the 21st Century. The forces of cultural diversity and global interdependence are cited as growing antithetical trends that will generate tensions which future leaders will face. Termed “connective,” such a world condition will test leaders’ abilities to shape inclusive, connected organizations. What has been dubbed the “industrial paradigm of leadership,”¹⁶ authoritarian, competitive, and individualistic, will be an anachronism in the 21st Century. Emanating from an ethical core, the new era, “connective” leadership “ennobles the spirit,” embraces humanity, and capitalizes on people and processes to solve problems, not exercise power.¹⁷

The criticality of core values is a recurring theme among “leading edge” scholars and scientists. As one author expresses it –

We want [leaders] to have integrity and we want them to have credibility. That means they must have clear values consistently acted upon, which is the foundation for everything they do, for everything the organization does, and for any attempt to become effective at managing and leading.... Leadership must be value-driven.¹⁸

There is general agreement that, among these core values, accountability and credibility are essential principles. Leaders must be held accountable and accept the consequences of their actions. Furthermore, credibility embodies the very essence of ethical leadership. Credibility stems from **commitment**; **character** (e.g., integrity, honesty, respect, and trust); **concern** for others; **courage**; and **competence**.¹⁹

Of course, the notion of ethical leadership is not foreign to the American military. Protection of the democratic principles upon which the United States was founded, the preservation of the inalienable rights of individuals, have been the solemn duty of soldiers since the days of the Colonial Army over 200 years ago. Generations of soldiers now have pledged to support and defend the

¹⁶ Frances Hesselbein, Marshal Goldsmith & Richard Beckhard, editors, *The Leader of the Future: New Visions, Strategies, and Practices for the New Era*, 1996, pp. 282-283.

¹⁷ Jean Lipman-Blumen, *The Connective Edge: Leading in an Interdependent World*, 1996, pp.3-27.

¹⁸ Stuart Wells, *From Sage to Artisan: The Nine Roles of the Value-Driven Leader*, 1997, p.4.

¹⁹ Frances Hesselbein, Marshal Goldsmith & Richard Beckhard, editors, pp. 281-292.

Constitution of the United States (e.g., oaths of enlistment/commission), inextricably linking the national belief in individual human worth with the Army ethic "duty, honor, country."²⁰ Military history is replete with examples of military leaders who have referred to core values as the very essence of leadership. Born out of their experience in both peace and war, they have stressed, in particular, the necessity for leadership that reflects character and compassion.

Some years ago, several students at the Army War College assembled a collection of letters, readings, and notes about warfare as seen through the eyes of those who had lived it. The quotes were passed on from Army officer to Army officer and served as a source of encouragement in times of personal reflection. Many of the selections were hand written and worn from being carried inside helmets, rucksacks, and map cases. Here is a sample of what military leaders expressed about leadership:

A leader's first priority should be treating his fellows with every kindness and humanity....Frederick von Steuben, 1789.

Two things an officer must do to lead men. You must care for the welfare of your men. You must show physical courage....Colonel Joshua L. Chamberlain, 1863.

The discipline which makes the soldiers of a free country reliable in battle is not to be gained by harsh or tyrannical treatment. He who feels the respect which is due others cannot fail to inspire.... General John M. Schofield, 1879.

Leadership requires human sympathy first of all.... General John J. Pershing, 1924.

The American people rightly look to their military leaders not only to be skilled in the technical aspects of the profession of arms, but to be men of integrity.... General Joseph Lawton Collins, 1944.

Leadership in a democratic army means firmness, not harshness; understanding, not weakness; justice, not license; humanness, not intolerance; generosity, not selfishness; pride, not egotism....

²⁰ Douglas MacArthur, "Duty , Honor, Country' " Address at the US Military Acadmey, May 12, 1962.

General Omar N. Bradley, 1945.

The badge of rank is a symbol of servitude – servitude to soldiers....General Maxwell Taylor, 1960.²¹

In short, strong moral fiber has always been the core tenet of Army leadership. In fact, ethical leadership has been an enduring constant throughout history. It remains relevant today, and it will continue to be so as the Army moves into the 21st Century. Hence, ethical leadership is truly a leadership for all seasons.

Army Leadership in the 1990's

The current Army Chief of Staff, General Dennis J. Reimer, has echoed the same abiding commitment to ethical leadership as those before him. Upon assuming the responsibilities of Chief of Staff of the Army, he identified Army core values as a principal area of emphasis for his term of office and directed they be codified in leadership doctrine. He has stated that "the Army is a values-based organization," specifying **honor, integrity, courage, loyalty, respect, selfless-service, and duty** as the "moral compass" of the Army.²²

Paradoxically, General Reimer's initiative comes at a time when Army leaders in general have been criticized for lacking moral courage. An annual survey of 24,000 personnel of the Active and Reserve Components determined that the Army's current command climate is deficient. Army leaders have a "zero defects" mentality (e.g., careerism, fear of delegating, micromanagement, unforgiving of mistakes, etc.) and ethical conduct is "abysmal."²³

An even stronger indictment of present day leadership was reported by the Secretary of the Army's Senior Review Panel on Sexual Harassment. The Panel traveled to Army installations worldwide and collected data from over 30,000 Active Component personnel. They reported that the Army has serious human relations problems and that "passive leadership" has permitted intolerance of others to pervade the Army.²⁴ Additionally, the Panel reported that soldiers do not have complete trust and confidence in their leaders nor do they

²¹ US Army War College, *The Reasons Why: An Anthology to the Centurions and Soldiers Who Fell So That America and Freedom Might Survive*, 1984.

²² US Department of the Army, *Field Manual 22-100: Army Leadership (Draft)*, 1997, p. 4-1.

²³ US Army Research Institute, *Assessment 95*, 1995.

²⁴ Richard S. Siegfried, Evelyn P. Foote, John P McLaurin, Claudia J. Kennedy, Larry R. Ellis, Ruby D. DeMesme, & Cynthia A. Pritchett, Panel Members, *Secretary of the Army's Senior Review Panel Report on Sexual Harassment*, 1997, P. 2.

believe their leaders really care for their well-being.²⁵ The panel also found that open communication between leaders and subordinates was often wanting.²⁶

Quite rightly, the Senior Review Panel expressed the concern that the "diminished" human relations environment would ultimately degrade combat readiness.²⁷ General Reimer observed that the force reduction of some 450,000 personnel from the Active and Reserve Components since 1989 had been difficult on soldiers and their families. Some feelings of disaffection within the Army had resulted.²⁸ What both the Panel and General Reimer recognized was that unit cohesion could be at risk. This condition has been described as "organizational anomie."²⁹

A term coined by the French sociologist Emile Durkeim in 1893, *anomie* refers to the malaise of groups where the individuals in the group have no sense of belonging. Durkeim studied the effects of mechanization on workers and discovered that workers felt isolated because machines cut them off from interaction with other workers. According to Durkeim, specialized labor prevented the workers from coalescing as a group. In the absence of human interaction, workers did not have an appreciation for group norms and values.

The message for the Army is powerful. "A values-based Army" cannot survive if human relations within the Army break down. Actualizing the "values-based Army" depends on human interaction. Moreover, leadership is fundamental to the process. The considerable body of research on unit cohesion substantiates that shared attitudes, beliefs, and experiences contribute to group solidarity more than other factors and that leadership plays the pivotal role in establishing symmetry between primary group norms and commitment to organizational goals and objectives.³⁰ If the Army is to uphold its revered tradition as a "values-based" institution, then the character of its leaders always must be kept intact.

Unit cohesion absent moral values can have dire consequences. For example, when the Canadian Airborne Battle Group was deployed in Somalia on a peace operation in 1993, Canadian soldiers tortured and killed a 15 year old Somali (Shidane Arone). The Commission of Inquiry into the incident found that the airborne soldiers' only loyalty was to their regiment. They were bound

²⁵ Richard S. Siegfried, et al, *Secretary of the Army's Senior Review Panel Report on Sexual Harassment*, 1997, pp. 71-72.

²⁶ *Ibid.*, p. 15.

²⁷ *Ibid.*, p. 14.

²⁸ Dennis J. Reimer, Chief of Staff of the Army, "Leadership for the 21st Century: Empowerment, Environment, and the Golden Rule," *Military Review*, January-February 1996, p.6.

²⁹ Susan Smith Kuczmarski & Thomas D. Kuczmarski, *Values-Based Leadership*, 1995, pp. 53-58.

³⁰ William Darryl Henderson, *Cohesion: The Human Element in Combat*, 1985.

together by a strong warrior ethos but lacked a moral base. Protecting each other and the reputation of the regiment was more important than sanctioning any member for abhorrent behavior. The Commission of Inquiry concluded that the Regiment's group norms were aberrant and inconsistent with the higher ethical code of the Canadian Armed Forces.³¹

This tragedy graphically demonstrates why ethical leadership is so important. Had ethical leadership been a part of the Regiment's group identity, such a grievous breach of discipline would have been unlikely. The censure of American leaders for a "zero defects" mentality should send off warning bells. General Reimer has called the "zero defects" mentality "a damaging philosophy that says it is worse to report a mistake than it is to make one."³² He is right, and the implications sound all too familiar in the broader context.

Leader Development

In anticipation of Army After Next, the Superintendent of the US Military Academy, Lieutenant General Daniel Christman, presents a compelling case for renewed commitment to Army leader development.

A continuing commitment to professional leader development is required to prepare for the broader range of challenges facing our Army in the 21st Century.... The new military challenges demand that officers have a heightened awareness of global cultures and history along with an uncompromising respect for the peoples of the world....In the 21st Century, compassion, as a fundamental leader attribute, will be increasingly relevant Leaders with the warrior spirit, who are physically fit and tactically proficient, are essential to the successful prosecution of warfare. However, only leaders of character, who respect the dignity of others, can be entrusted to use that violence the right way.³³

Clearly, interpersonal skills will be a key component of the professional preparation of the officer corps for the Army After Next. Ironically, though, on the

³¹ Donna Winslow, *The Canadian Airborne in Somalia: A Socio-cultural Inquiry*, 1997.

³² Dennis J. Reimer, Chief of Staff of the Army, "Leadership for the 21st Century: Empowerment, Environment, and the Golden Rule," *Military Review*, January-February 1996, p. 7.

³³ Daniel Christman, Superintendent, US Military Academy, "21st Century Leadership: The Broadened Attributes of a Soldier," Unpublished, 1997, p. 1, 7, 9.

eve of the new century and the dawning of the Information Age, the ability of Army leaders to communicate in the most basic way (e.g., send; receive; understand) has been called into question. Obviously, leader development must address this issue.

The Institutional pillar of Army leader development (e.g., institutional training) recognizes three categories of leadership competency – technical, interpersonal, and conceptual. Significantly, cohesive leadership is based on personal relationships between leaders and soldiers.³⁴ However, the implementation of Army leader development focuses heavily on the technical element, perhaps to the detriment of providing officers the foundation they have needed to handle the human relations environment of the 1990's and certainly those they will face in the 21st Century.

Since the end of the Cold War, the world has changed, the Army has changed, and our soldiers have changed. Now, leader development must change, too. Army leaders face a fundamentally altered future with a skill set that has ill-prepared them to see change in human terms or relate to a new generation of soldiers. The challenges wrought by an ever more dynamic environment include the ability to lead, not only as past experience has taught, but also as the complexity of the 21st Century will demand. The reality of stability and support operations and coalition task forces suggest that sensitivity to world cultures and respect for their peoples is a key operational requirement. Similarly, the transformation the Army into an increasingly diverse force over the past 25 years and the imminence of Work Force 2000 make human understanding and compassion essential leadership attributes for the Army After Next. Steps must be taken to restore communication, listening, and interpersonal relations skills to rightful importance as leadership competencies and to incorporate their training into all leader development courses.

Finally, the ethical leadership model must be institutionalized. Proficiency, good order and discipline, Army values, and teamwork are all paramount to the continuing vitality of the Army. Correspondingly, Army leadership must reflect competence, character, and compassion. It is not an either or proposition. All elements are essential. What is especially remarkable about the incorporation of Army values in Army doctrine in the soon-to-be published *Field Manual 22-100: Army Leadership* is not that the Army recognizes the unequivocal "connectivity" of ethical leadership to warfighting, but that the articulation of **honor, integrity, courage, loyalty, respect, selfless-service, and duty** are a recent addition to the Army lexicon. If the current generation of Army leaders have failed to

³⁴ William Darryl Henderson, *Cohesion: The Human Element in Combat*, 1985, p. 114.

understand and internalize these values, then their Army "culturization" has been flawed.

Although there are various commissioning programs (e.g., US Military Academy, Reserve Officer Training Corps, Officer Candidate School), all share a mutual objective to develop officers of character, imbued with a sense of duty, a code of honor, and an ethic of service to country. At the US Military Academy, the honor code is bedrock to a cadet's educational experience, requiring each cadet to maintain utmost integrity as a condition of enrollment. Recently, respect and dignity for others become a second bedrock value. While still maturing, given Lieutenant General Christman's vision, one can foresee the blending of respect and dignity for others with the honor code and a strengthening of the character development process of the US Military Academy cadets. The bedrock approach has been proven to be an effective model for shaping leader character at the US Military Academy and should be adopted as a common standard for all commissioning programs. Additionally, it seems a natural progression to institute the bedrock philosophy in all officer basic courses as a means of further inculcating institutional core values.

Conclusion

Like the Constitution, the military code of honor has stood the test of time. Ethical leadership of soldiers is ageless and immutable. In the new century, which portends of continuous dynamism where the only true certainty is the reality of constant change, its relevancy is absolute.

The Force XXI initiative to redesign the Army began the Army's journey into the 21st Century. The rudimentary first step in that process was to define the core competency of the Army. After much collaboration, deliberation, and refinement, the core competency of the Army was defined to reflect that **soldiers are the core of the Army** (e.g., "soldiers and those who support them capable of prompt, sustained, operations on land").³⁵ The companion piece to the Army core competency must necessarily be Army core values. In preparation for the Army After Next, the Army must embrace the ethical leadership model.

³⁵ US Department of the Army (DA), *DA Pamphlet 100-XX (Final Draft): Force XXI Institutional Force Redesign*, 1996, p. 40.

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LEADERSHIP IN THE ARMY AFTER NEXT

Bernard M. Bass

Center for Leadership Studies

State University of New York at Binghamton

In discussing leadership requirements in the Army of 2025, I will take into account expectations about the geo-strategic setting in 2025 of the Army After Next (AAN), its technology and art, as well as the human and organizational issues it will face. In doing so, I will look at the leadership requirements for the AAN's readiness for war-fighting peer competitors, regional conflicts, and low-intensity confrontations. Then I will attempt to predict leadership requirements of the AAN in winning and maintaining peace.

Assumptions

Several assumptions will underly what I have to say:

First, the principles of leadership do not change; only the conditions in which they are applied. Over time, we obtain a better and more accurate understanding of the concepts and principles but they were in effect as *Initiation* and *Consideration* when Julius Caesar exhorted his troops before storming Alesia although it took us 1900 years to refine and measure the concepts (Bass, 1960).

Second, much of U. S. Army doctrine has attempted to fit with these principles, changing over time, mainly in interpretations and applications.

Third, although the principles are the same at all levels, the practices need to be differentiated for junior, senior and strategic leaders.

Fourth, U.S. Army doctrine has been espousing these principles for 200 years of trusting subordinates and earning their trust, respecting them, and “engaging their voluntary commitment to the mission by giving them honest and complete information” but the behavior of leaders in army has “deviated sharply from policy”(Kirkland, 1991, p.317). For instance, although mentoring of junior officers by senior officers is a well-established principle, 85 per cent of junior officers report they only receive support from such counseling less than one week before the Officer Efficiency Report is due (Stroup,1996). So whatever we say here about the requirements for leadership in 2025, paramount should be increasing the match between leadership behavior and leadership doctrine.

The Full Range of Leadership

For purposes of discussion, I will make use of a theory and model of leadership (Bass & Avolio) which has accounted for effective leadership in the military and elsewhere (Bass,

1997). However, I will focus on how practices in its applications will fit with the needs for leadership in the AAN.

The theory is that of transformational and transactional leadership (Bass, 1985, 1997) and the model of their relationships is the Full Range of Leadership (Avolio & Bass, 1991). (FRL). The theory explains that leaders must mobilize their followers to go beyond their self interests for the good of the group, organization, and/or society while building the self-esteem of the followers and keeping in mind their self-interests. The most recent confirmatory factor analysis of 360* behavioral assessments of platoon leaders and platoon sergeants suggests that the best fitting model includes the following transformational factors:

Inspirational Leadership: Leaders are trusted and valued. They provide meaning and challenge, set examples, and envision and articulate attractive goals and futures.

Intellectual Stimulation: Leaders help followers to become more innovative where appropriate.

Individualized Consideration: Leaders attend to the individual needs of their followers as well as to the needs of their units.

The *transactional* factors are as follows:

Contingent Reward: Leaders reward followers in exchange for followers' carrying out their assignments

Active Management-by-Exception: Leaders monitor followers for deviations and errors and take corrective and disciplinary actions as needed.

Passive Leadership: Leaders wait for problems to emerge before correcting, or they avoid taking actions.

Effective Leadership in War-fighting in 2025

Consistent with previous meta-analyses of military as well as civilian investigations (e.g., Lowe, Kroek & Sivasubramaniam, 1996), the profiles of the platoon leaders and platoon sergeants who subsequently lead more effective platoons in Joint Readiness Training Center Exercises reveal behaviors earlier in garrison that are more transformational and less transactional and passive(Bass & Avolio, 1997). CO's who are seen as more transformational and less transactional have more constructive self-images, create more feelings of empowerment in their subordinates and higher productivity in their units (Masi, 1994).

I expect that the same will be true in the AAN of 2025 although much can be said about how this will be played out in practice in the AAN 28 years from now for in 2025, it is expected to be an Army which will deploy extremely quickly, be logically self-sufficient, be intelligence-rich and facile with instant information about its own and enemy forces and conditions. Personnel will be widely dispersed per square mile in the battle-contested ground, air, and space above. Units will be small and linked mainly by information to each other and

to higher command. Organizations will be flatter than today's. These fast-moving, highly maneuverable units will have great firepower.(Anon., 1997).

Given the rate of change in information technology, I expect that today we are likely to greatly underestimate the state of the art in 2025. The flow of information upward, sideways and downward is likely to be timely, precise, accurate and open to immediate feedback with computerized support for prioritizing and analyzing. Much will be by voice input and output and secure against enemy penetration and viruses. It would be expected that all combatants will be briefed on objectives, goals, and expectations on a continuing basis. They would be part of and be participants in information processing, tactical thinking, and mission accomplishment. *Individualized consideration* would be at a premium in the need to be ready for instant feedback from above, laterally, and below. Information overload and enemy infiltration would be problems for the leadership to monitor and control. Risk of our soldiers being captured with too much information to be squeezed out beyond rank, name, and serial number would also be a problem to be wrestled with. Leaders would need to know ways around system disruptions and glitches. They would require the capabilities of quick adjustments of mission plans and orders to maintain progress toward mission achievement in a dynamic, tactical environment. These are just a few examples of the overriding need for individuation in leadership.

In 2025, the Army will be in transition from the legacy of Army XXI to the Army After Next and integration will call for individualized consideration. Such consideration would also be needed in integrating efforts in the joint service environment and with Allied forces. And individualized consideration as well as transformational leadership, in general, would be important in establishing and maintaining the cohesiveness seen to be so relevant for success (Bass, 1997).

Leadership and Unit Cohesiveness

Cohesiveness encompasses both the horizontal social bonding among peers and the vertical social bonding of superior and subordinates based on the development of trust and interdependence (Bartone & Kirkland, 1991). Strong evidence points to the contribution to such cohesion of all three factors of transformational leadership. Within the cohesive team, *inspirational* members set examples for each other and foster acceptance of mutual goals. *Intellectually stimulating* members build on each others' ideas and develop a sense of ownership in solutions to problems. Team cohesion is further strengthened when members are *individually considerate* and show they care for each other.

Just as team cohesion depends upon the leadership displayed within the team by the different team members, so we see a strong connection between the leadership displayed by the formal leader of the group and the loyalty, involvement, commitment and attraction to the unit of its members. By providing meaning, challenge, and a role model of confidence and determination, *inspirational* leaders help to promote identification and internalization of cohesive values and beliefs in their unit. *Intellectually stimulating* leaders encourage better use of resources and contributions to solutions to problems increasing feelings of worth and confidence in the unit led. *Individually considerate* leaders likewise increase subordinates' sense of self-worth enhancing positive feelings toward the unit and its leaders.

Bartone and Kirkland(1991) have shown how the critical leadership required for developing unit cohesiveness can be seen in stages from the new unit to the fully developed one. Leaders should be commended for the extent they are able to develop such cohesiveness in their units and supported by personnel policies that avoid unnecessary transfers and replacements. The effective orientation and integration of new members into old teams is an important *individually considerate* leadership competence.

Cohesion is a double-edged sword. It is a strong predictor of unit effectiveness when there is an alignment of the goals of the unit and the goals of the organization. But it can also be a strong predictor of the opposite. When the goals of a cohesive unit are opposite to those of the organization, the stage is set for sabotaging the organization. Effective leaders attend to the positive alignment of unit and organization goals. The seamless flow envisaged of arrival into the theater of war of forward presence forces, early arriving light forces and later-arriving heavy forces requires such positive alignment of all involved. It goes without saying that the AAN will require cohesive units and mature leadership.(Anon, 1997,July)

Decentralization

In industry, we have seen a sharp increase in decentralization which at the extreme end has produced the self-managed team. Such decentralized operations are seen for the AAN to provide the tactical speed and agility to win battles. "Professional trust and confidence between leaders and led" (Anon.,1997,July,p.21) will be essential. At the organizational level, flexible architectures will need to be designed of self-contained units that can be detached for missions in isolation and that can be reformed quickly and reintegrated into larger units. The speed and tempo of future battle will require flattened organizations with fewer echelons in the chains of command. This in turn will move leaders at the different echelons to rely more on *active managing-by-exception* to accommodate the larger number of direct reports. They will be helped with computerized decision support systems for situational analyses, coordination, communication, command and control.. But it will also mean that they should be increasing how much authority, flexibility, and freedom of action they delegate to subordinates who, in turn, will keep their leaders fully informed about discretionary actions.

Delegation from one echelon to the next one below it is 100 percent when those at the lower level are organized into self -managing teams. It is zero percent when all actions at the lower echelon require orders from higher authority. A central theme for future research should be to what extent at all echelons of the AAN, every individual could become involved in leadership functions. Does shared responsibility mean that no one is responsible? Can every soldier be trained and ready to take on one or more of the roles of his leader when he sees the role is needed but missing? What would the rules be for doing so? How much could current leader roles be delegated ? How much self-management could be introduced into the squad? platoon? company? There is an evident trend in the Army to push decision-making downward. The TOW team leader, a junior non-com, now makes decisions that a captain made in World War II(Anon.,1997, March)

Every Soldier a Leader?

In all our wars, the individualism of the American soldier has been both a curse and a blessing to their leadership. There has been a pervasive suspicion of authority and a resultant resistance to discipline (Dupuy & Dupuy, 1959). But as S.L.A. Marshall (1964) pointed out, our European allies in World War I could not believe how rapidly we could train and supply our own platoon leadership with 30 day wonders because of the trait of initiative built into the American culture. And Dupuy and Dupuy added that our soldiers were self-reliant and combined imagination with intelligence often making it difficult for their leaders to stay one “mental jump” ahead of them.

Teleteams

We are already seeing the teleteam in operations. The teams are connected by e-mail, FAX, and telephone and don't meet face-to-face. We know little about how to lead such teams. As someone trying to do so, I can list some of the questions I have had in the process:

How confident and certain should I be before sending out a controversial E-mail message which is non-recallable and about which I can only guess at the reactions? How much can I and should I encourage all-channel networking? How do I ensure as much two-way communication and avoid too much one-way communication? How do I decide who needs to know what? How often am I kept out of the loop when team members interact with each other? What's the best mix of e-mail, FAX and telephone? How do I deal with the fact that some members respond immediately to questions while others take a week or more?

Teleteams can be combined with group decision support systems(GDSS) to give teleteam leaders rapid collection and merging of proposals, and consensus about priorities and evaluations. Teleteams and GDSS are likely to provide the necessary linkages among the isolated, logically self-contained units and individuals of the AAN's battleground. All echelons will need to be trained and experienced in the use of GDSS and given practice in simulation exercises.

Conceptual Skills

Based on his analyses of cognitive and personality data of generals, Campbell (1987) noted that as a group they were in the 95th percentile in intelligence compared to the population as a whole. They were extremely dependable, socially mature, alert to moral issues, competitive and action-oriented. At the same time, in comparison to civilian executives, they were more conventional and less innovative in dealing with problems. If this is commonly true for other ranks as well, the AAN should place a high priority on leadership which is *intellectually stimulating* and on selection and training of cognitive skills promoting innovative thinking.

Subordinates will need to be able to follow orders with “intelligent compliance”. The union of knowledge and speed will obviously increase the demand for the decisive leadership

reflected in transformational leadership, highly coordinated communications, keen diagnostic abilities and a build-up of intuition based on attention to and recall of a variety of relevant past learnings and experiences. A balance will need to be sought between the purely rational approach to problem-solving and the intuitive. The emotional will need to be factored into intellectual solutions.

Van Crefeld(1990) has argued that post-graduate military education does not necessarily enhance command ability. Perhaps some of what is missing is the education in how to balance the rational and the intuitive.

Increasingly, team effort is sought requiring leaders with the cognitive skills to develop their subordinates into teams and they, the leaders need the cognitive skills required to function effectively as good team players.

The technological availability of instant information suggests that research is needed on how more open communications could be made across echelons in the chain-of command without jeopardizing coordination, conflicts in messages, and threats to authority and responsibility. Strengthened feedback loops coupled with computerization to deal with overload would be required. With the greatly increased use of manned and unmanned aerial vehicles for intelligence, firepower, logistics, and communications, the *spatial visualization* envisioning the three-dimensional battlefield will become as important a cognitive skill to the tactical commander as it is to the engineer. “Quicken” makes possible the underwater “flying” of submarines by presenting the pilot with a computerized display of what will be ahead of the submarine to enable advance maneuvering in the steering of the submarine. Analogously, I would expect that some form of such quickening will be provided tactical commanders to assist rapid decision-making and communication of the decisions.

Assessment and Training for Leadership in the AAN

“The mature leaders leading cohesive groups” envisaged in the AAN (Anon, 1997, July), call for assessment and training that increases transformational leadership and reduces passive *management-by-exception* and *laissez-faire* leadership among leaders and teams. Already developed are on-line 360° interactive feedback systems which could be tailored for use by leaders at all echelons of command. On-line feedback could also be added for senior leaders about the platoons, companies and battalions under their command. And strategic leaders could receive on-line feedback about the units under their command. They could also receive on-line feedback from civilian “clients”, civilian peers and politicians..

Although technology such as the MILES program at NTC can provide objective data about the hits, misses and “casualties” sustained of platoons, companies, and battalions, research is needed on the conditions under which the data could be used convincingly as criteria to evaluate assessment and training.

Shamir and Ben-Ari (1996) have already laid out many aspects of leadership for Army XXI which will continue to be true for the AAN: teleleadership, telemedicine, cultural pluralism, flattened organization, loosely coupled structures, professionalism, teamwork, etc

They expect that respect, loyalty, identification, competence, self-control, inspiration and personal example will be important in Army XXI as it is today. They will be likewise in the AAN.

Shamir and Ben Ari They argue for a generalized theory of leadership that transcends contingencies. They presaged that as Bass (1997) proposed, the concepts and principles of the Full Range of Leadership are universal although they may be expressed in differing ways across organizational and national boundaries.

Leaders are born *and* made. A strong genetic component has been unearthed in a number of personality traits such as the absence of shyness which correlates with leader behavior. Even more significant is finding that as much as half the variance in the components of self-assessed transformational and transactional leadership can be accounted for by heritability according to a private communication from Tony Vernon. A large-scale analysis was proposed of a 360° study of leaders (Bass, 1995).

On the one hand, genetic profiling will be commonplace by 2025. On the other hand, its application to selection will remain an ethical question. It will be seen as being discriminatory against some individuals for such screening will deny them opportunities as victims of unmodifiable characteristics. But this is already done with individuals who are less than minimum height which, unlike an individual's weight, is unmodifiable. It is expected that such standards, which cannot be met through development, will have to be reexamined from time to time. For instance, chronological age limitations may need to be raised to fit the increasing size and physical fitness of our aging population.

Other Ethical and Moral Issues

The speeding-up of the time available for decisions will increase the difficulties of ensuring that the ethics and morality of decisions are maintained. Wheeler (1979) , writing about current conditions, pointed out that "...in combat environments, there is usually some reasonable delay between the giving and the carrying out of an order. This interval allows some time for reflection upon the order, and reflection may produce a concern for the rationale of the order. Why was the order given? What purpose does the order seek to obtain?" (p. 181) Because of the speeding-up of action on the AAN battlefield, decisions may be made and orders carried out which later after-the-fact may be regretted as immoral. It will help if soldiers' information processing and response skills including ethical aspects are developed and internalized for engagement in the hyper-battle environment.

Sorley (1979) suggests that younger officers often have more of an ethical sense than their seniors because seniors are more likely to have been affected by corruption in the system. If this is true, then attention must be paid to remedial work on the systematic sources of unethical behavior. Moral beliefs in the value of life may be sorely tested in the AAN when going up against suicidal bombers or 10 year old children armed with Kalishnikovs. Enemy forces that refuse to surrender even when in hopeless situations will have to be dealt with firmly.

AAN personnel at all echelons will be reasonably well educated and find some of the low-intensity or regional conflicts in which no vital interests of the nation are at risk. As with Viet-Nam, their reluctance for the engagement may also be reinforced by the media and the unpopularity of the decision for the United States to become involved. Our AAN military leaders may need to be prepared to deal with conducting actions in which AAN personnel find it unjustifiable (Shamir & Ben-Ari, 1996).

Multiple Goals

Moskos and Burk (1995) listed the varied missions of U.S. forces during just a 21-month period between April, 1991 and December, 1992. They included refugee relief in Kurdistan, flood relief in Bangladesh, volcano rescues in the Philippines, observer forces in the Western Sahara, rescue of foreign nationals in Zaire, Haitian refugee relief, food relief in Russia, volcano rescues in Sicily, restoring order in south-central Los Angeles, famine relief in Somalia, hurricane disaster relief in Florida, surveillance in Iraq, hurricane disaster relief in Hawaii and peacekeeping in Somalia. Since then, we have seen the Army engaged in such varied missions as combating the drug cartels of Colombia, patrolling of the border with Mexico to reduce illegal immigration, and peacekeeping in Bosnia as we continue to do in the Sinai. .

It is clear that in 2025, Army units are likely to be employed much more in such varied work than in combat. Despite this, the units must be kept ready through training and retraining as the world's most powerful deterrent force and for rapid entry into combat when necessary. (Segal & Eyre, 1996).

Winning the Peace

The proposed requirements for the capabilities needed in the AAN thus would be incomplete if I failed to address the truly ultimate purpose of fighting wars when deterrence fails and peace is untenable.

The goal of war-fighting is usually couched in terms of bringing force and fear of it on the enemy so that its will to resist is broken. But this can be seen as intermediate to the ultimate goal of establishing a lasting peace with the former enemy—be they rogue governments or illegitimate terrorist organizations. Although such a peace will depend much on the new relations which are established between the previously warring enemies, it will also depend on the behavior of the military forces during the conflicts. As they bring force and fear to break the will to resist, they can also bring the promise of a just peace that is more attractive than continued fighting.

At the start of the Mexican War in 1846, Brigadier General Stephen W. Kearny was ordered to lead his Army of the West of 300 regulars and 2400 militia from Ft. Leavenworth south to seize what is now New Mexico and then move on to take California. He faced 3000 Mexican troops waiting for him enroute to Santa Fe. He sent an emissary ahead that convinced the Mexicans that he was coming down with an overwhelming larger force so they moved out without a battle.

Kearny was determined to win the peace with a people he had just conquered. They were of a different language, traditions and religion, who has been living in the territory for almost 250 years. Here are excerpts from what he proclaimed to the assembled populace in Las Vegas, New Mexico:

**PROCLAMATION OF BRIGADIER GENERAL STEPHEN W.
KEARNY, to the PEOPLE OF LAS VEGAS, AUGUST 15TH 1846**

Mr. Acalde, and people of New Mexico: I have come amongst you by the orders of my government to take possession of your country... We come...as friends-not as enemies; as protectors not as conquerors. We come among you for your benefit - not for your injury. Henceforth I absolve you from all allegiance to the Mexican government, and from all obedience to General Armijo. He is no longer your governor. I am your governor. I shall not expect you to take up arms and follow me to fight your own people, who may oppose me; but I now tell you that those of you who remain peaceably at home, tending to their crops and herds, shall be protected by me in their property, their persons and their religion. Not a pepper nor an onion shall be disturbed or taken by my troops without pay or by the consent of the owner. But listen! He who promises to be quiet and is found in arms against me, I will hang. From the Mexican government you have never received protection. The Apaches and Navahos come down from the mountain and carry off your sheep, and even your women whenever they please. My government will correct all this. It will keep off the Indians, protect you and your persons and property and, I repeat again, will protect you in your religion. I know you are all great Catholics; that some of your priests have told you all sorts of stories that we would mistreat your women and brand them on the cheek as you do your mules on the hip. It is all false. My government respects your religion as much as the Protestant religion, and allows each man to worship his Creator as his heart tells him best. The laws protect the Catholic as well as the Protestant, the weak as well as the strong, the poor as well as the rich. I am not a Catholic myself ...; but at least one-third of my army are Catholics. I respect a good Catholic as much as a good Protestant. There goes my Army- you see but a small portion of it; there are many more behind; resistance is useless. Mr. Acalde and you two captains of militia, the laws of my country require that all men who take office under me shall take the oath of allegiance. I do not wish, for the present, until affairs become more settled, to disturb your form of government. If you are prepared to take oaths of allegiance I shall continue you in office and support your authority.

Kearny won popular support by a promise of democratic government. The Kearny Code, based on translation and codification of Mexican provincial laws, became the basis of law in New Mexico. He left a supportive populace behind when his expedition moved on to take California. If he had concentrated on only destroying the will to resist, he could readily have alienated the population and set back for many years the integration of Hispanic New Mexico into the United States. Kearny clearly kept his eye on using his force to win the peace. He exhibited the political sensitivity, intellectual awareness and familiarity with the norms, mores and culture of the environment in which he was operating, characteristics which Shamir and Ben-Ari(1996) see as needed by military leaders who must span the

boundaries from their organization to negotiate effectively with civilian populations in their midst.

The Mexican War provides an even better example in the contrast between the actions of General Zachary Taylor and General Winnfield Scott, one who alienated the local populace hardening the fighting and the other who attracted their support and smoothed the path to victory and peace.

The transactional/transformational profile of the most effective leadership in war-fighting is not necessarily likely to be the same as the profile of the most effective leadership in peace-winning. Although transformational leadership will still be more effective than Contingent Reward and Active Managing-by-Exception will be more effective than Passive Leadership in both war-fighting and peace-winning, peace-winning may call for more Intellectual Stimulation and Individualized Consideration; war fighting may place a greater premium on Inspirational Leadership and Idealized Influence. Contingent Reward and Management-by-Exception may be reflected in different behaviors in war-fighting and peace-winning.

To illustrate: Individualized Consideration is involved in taking special actions to deal with local feelings. Given wide media coverage, the actions may become the basis of a change of attitudes in a whole population. General Kearny's promises of religious freedom and maintaining support of local authority are examples.

Contingent Reward occurs in peace-winning negotiation of rewards for compliance. Thus, Kearny promised protection for allegiance to him.

Management-by-Exception is required to win the peace. Order must be reestablished. Discipline must be maintained but peace-winning works best when it emphasizes the positive as in Contingent Reward and Transformational Leadership but Kearny's threat to hang secret armed opposition emphasizes that disciplinary cautions have their place.

Laissez-faire leadership and Passive Management-by-Exception remain contraindicated in both war-fighting and peace-winning.

As peacekeeping competes with war-fighting for the services of the AAN, preparation will be needed at all echelons for the different, sometimes opposite roles required. Instead of keeping one's head down and concealing one's presence in military conflicts, it will be necessary to learn to keep one's head up and to advertise one's presence as a peacekeeper. Overlearning these opposite skills will be required for the correct rapid reaction in either the war or peace conditions.

When called upon to pacify a population, the AAN will need to be prepared to work with local police to seek out local rabble-rousers. Equally, important will be the need for the AAN to learn how to convert enemies into friends. The reemergence of Japan and Germany after World War II as allies contrasts sharply with the call for revenge by the French for 45 years after the Franco-Prussian War. The Japanese, the Germans and the French all had been subjected to humiliating defeat but the different outcomes following victory were partly due

to the differences in behavior of the military victors. It is partly a matter of how the U.S. military leaders at all levels contrasted with their German counterparts, particularly as occupying forces. Villages all over Serbia have their museums displaying the photographs of the civilians massacred by the Germans and Croats during World War II. The Croats and Serbs remain at each others' throats. While the American Army brought about peace in the West with our Native Americans by almost destroying them, in recent confrontations and occupations, the record is mixed. Historical research may be useful in showing how American service personnel and the Army as a system behave in ways that contribute to winning the peace.

Currently, the regular Army has one Civil Affairs battalion and four reserve battalions. In the AAN, minimally there would need to be increased importance attached to the role of civil affairs, particularly in joint training exercises with combat units. Civil Affairs will need to be in a position to form joint operations with combat units, for instance, to provide both the carrots and sticks in counterterrorism missions. Such joint efforts characterized the British and Australian success in defeating the guerrillas in Malaysia in the 1950's.

When war-fighting's objective is eliminating the enemy's will to resist, then spreading in advance, fear and a sense of hopelessness among the enemy, will remain important to AAN's arsenal although fear often results in unpredictable consequences. If the ultimate objective is winning the peace, then it makes sense to spread in advance among the enemy the benefits of avoiding battle and joining rather than fighting us. In the AAN, PSYOPS and Civil Affairs will need to be expanded in resources, planning, scope and readiness with fuller integration training and operations with combat units. The power of TV, radio, internet and newer forms of communication yet to be invented and deployed, will need to be exploited much more than is possible today. More local culture specialists will need to be trained and ready to serve in the world's perceived hotspots. Relations between combat and civil affairs personnel at all levels of command will need to be practiced to make for seamless operations. War-fighting and peace-winning will need to be factored into strategies and tactics. In all, the AAN will need to avoid winning the war but losing the peace and at the same time not incurring additional costs and casualties in doing so.

Priorities

In looking ahead to the AAN of 2025, we certainly are not preparing for the last war. However, particularly in an era of stable or declining budgets, we have to take care on how we allocate our resources to preparations for low-intensity conflicts, regional conflicts, and the threat from a newly-emerging belligerent great power. The probabilities are high of future low-intensity conflicts, intermediate for regional conflicts and low for the emergence of a peer power (Even at the height of the Soviet Union's perceived power in 1984 to engage us in a war, 88% of 257 U.S. generals and admirals thought such a war was most unlikely to occur)(NEWSWEEK, 1984) But the threats to our national security of low intensity, regional, or great power conflicts is in reverse of their probabilities of occurrence..

Taking into account both the probability and the severity of the threat to security, it would seem that we need to give about equal priority to be ready for all three possibilities.

We should seek ways to develop tools, techniques, training and organizations that are multipurpose. An example would be highly trained, easily transported light infantry with air support and civil affairs capability to combat the high probability of future banditry and terrorists as well as the lower probability of regional and global conflicts. Such infantry could also be the backbone of diplomatic and economic missions to peacefully settle disputes within and between nations (Anon, 1996, December). These active force units would provide the “roots on which to graft mobilization forces” and would be targeted against predictable threats. They could be combined rapidly into larger units as needed. Reserve units would be readied for unforeseen contingencies (Shanahan, 1997). Leaders and their units will need to be flexible, adaptive, innovative and intellectually agile as transformational leaders and transformational teams would be..

To conserve our own forces, we should continue supporting alternatives to using our own forces to intervene in conflicts, particularly when their outcomes are not vital to our national interests. For instance, we should continue to help and train a pan-African force for such interventions in the disruptions that plague the continent. At the same time, such training will need to avoid the creation of anti-democratic military elites such as occurred in El Salvador. High priority will have to be given to working with Allied forces in joint actions. The AAN will need to be ready to learn from its allies as it shares its skills with them.

Diversity

With the continued movement towards sex equality and the continued increase in the persons of color in the U.S. population, women will engage in more diverse roles than they do today and units will be more multi-ethnic and multi-racial than today. Advances in tools, training and technologies as well as further social change may see women in the infantry. We are likely to see women in combat roles and in a variety of additional support combat services such as flying reconnaissance aerial vehicles.

The entry of large numbers of Asian-Americans into higher education, particularly high- tech education, may result in an increasing number entering the officer corps, and technical career specialties in the military. Similarly, by 2025, in the U.S., Hispanics will be our largest minority. We should see larger numbers enrolled in the Army if they, constituting the largest per capita Medal of Honor winners for an ethic group, continue their tradition of seeing service as consistent with their Macho values and as the way out of the barrios. The Army should remain attractive to African-Americans, and we should see more at higher officer levels.

In all, the AAN is likely to be less white in 2025 mirroring what will have occurred in the population of the United States. Learning to lead and to work in multiethnic, multiracial and mixed-sex groups will be of even more significance to the readiness of the AAN. than to today's Army.

Similarly, retirement ages may be extended matching the increasing numbers and health of older personnel.

Whatever elitism the service academies might introduce into the AAN officer corps is likely to be diminished further either with the possible abandonment of the academies or the increasing roles of the universities in providing the corps with more broadly educated leaders with more diverse developmental and community experiences.

Some Unanswered Questions

In looking ahead 28 years, additional questions remain. Are we tending to see solved our problems of today, not the problems of 2025? For instance, 28 years hence, will we see that the anti-heroism featured in so much of the media entertainment today, has eroded many of the values important to leadership? Can leadership as we now know it, with its recognition of the importance of respect, decisiveness, and direction be sustained in a world dominated by glorification of underclass values? Will our future development of leaders be handicapped by less devotion to our civil duties than to our civil rights? How much will self-management take root in civilian life and how will it affect military organization? What will be the effects of the world's rapidly growing urbanization on the AAN? How will recruiting be affected by the sharply rising obesity and junk food nutrition of today's American children? What will be the affect the movement of more women and minorities into positions of senior and strategic leadership in the AAN? Will we see strong mainstream backlashes?

At the approach of the second millennium, we are transiting rapidly into the Post-Industrial Information Age. Information is expandable, compressible, substitutable, transportable, diffusible, and shareable. It is not necessarily a scarce resource (Cleveland, 1985). As a consequence, it will affect leader-follower relations in ways yet unseen. Leader-follower relations will become increasingly fluid rather than fixed in a person or position so it will make it difficult to capture what lies ahead for the leaders and the led.

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TECHNOLOGY FOR THE UNITED STATES NAVY
AND MARINE CORPS, 2000-2035
HUMAN RESOURCES PANEL

SUMMARY

J.D. Fletcher

Institute for Defense Analyses

I. Introduction

As the 20th Century closes, the United States is pursuing a world-wide foreign policy. It is one of the few countries, and in many instances the only country, capable of leading in international politics. A principal tool of this American leadership is its armed forces. This will surely be as true in 2035 as it is today.

Many features of the present world order are likely to exist in 2035, but it is also likely that the United States will face, in one form or another, competition for world leadership and possibly an emerging, powerful adversary. The armed forces will be no less important in 2035 than they are today, and their capabilities and competence may well become more important. One difference between 1997 and 2035 will be the dramatic advances in technology and its applications that will have occurred over these years.

Such advances in technologies represent both significant challenges and opportunities. The Navy and the Marine Corps must adapt to these advances and make the most of them if they are to meet their responsibilities for leadership among the world's military organizations. These adaptations must not be limited to the acquisition of materiel. Without the people -- the human competence -- needed to operate, maintain, deploy, and command our materiel assets, investment in these assets will return far less than we anticipate and may, in fact, be wasted.

Modernization should also include procedures and processes for recruiting, training, educating, managing, and supporting people. Initiatives in these human resource areas will also benefit

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from technological advances and should keep pace with investments in technology made elsewhere. They cannot wisely be shortchanged in favor of materiel acquisition. They are modest compared to investments in materiel and will support themselves. Most importantly, they will yield significant advances in naval force effectiveness.

The criticality of human performance to Navy and Marine Corps operations and its effective development and management were recognized in the Terms of Reference for the original Navy-21 study.¹ This earlier study foresaw:

- o Increasing system complexity;
- o Long operational periods away from home;
- o High demand for high-aptitude people;
- o A smaller, more mature, and more proficient force whose members are retained longer in the Service;
- o Increasing need for reliable, easily used equipment to reduce manning requirements;
- o Increasing substitution of intelligent machines for people;
- o Increasing use of advanced technology for training; and
- o Increasing use of embedded training to distribute training to distributed forces.

Many of these trends are carried forward into the current report,² as are the concern with human performance and the necessity of ensuring human competence in our naval forces. The present study seeks, in part, to update Navy-21 findings in the light of technological and strategic changes that have occurred in the intervening 10 years. It also responds to additional tasking in the areas of quality of life and medical care.

¹ Naval Studies Board. 1988. Navy-21: Implications of Advancing Technology for Naval Operations in the Twenty-First Century, Volume 1: Overview, National Academy Press, Washington, DC.

² Naval Studies Board. 1997. Technology for the United States Navy and Marine Corps, 2000-2035, Volume 4, Human Resources, National Academy Press, Washington, DC.

DRAFT**II. The Human Resources Panel**

The Human Resources Panel addressed the following issues, which were raised in the Terms of Reference for the present study:

- "7. In the future, Navy and Marine Corps personnel may be called upon to serve in non-traditional environments, and face new types of threats. Applications of new technologies to the Navy's medical and health care delivery systems should be assessed with these factors, as well as joint and coalition operations, reduced force and manpower levels, and the adequacy of specialized training in mind.
- "8. Efficient and effective use of personnel will be of critical importance. The impact of new technologies on personnel issues, such as education and training, recruitment, retention and motivation, and the efficient marriage of personnel and machines should be addressed in the review. A review of past practices in education and training would provide a useful adjunct.
- "9. Housing, barracks, MWR (morale, welfare, and recreation) facilities, commissaries, child care, etc. are all part of the Quality of Life (QoL) of naval personnel. The study should evaluate how technology can be used to enhance QoL and should define militarily meaningful measures of effectiveness (for example, the impact on Navy readiness)."

These Terms of Reference suggest a very broad review of human resource issues. The Human Resources Panel focused on the following four areas:

1. Manpower and Personnel. How can technology improve performance while reducing manning requirements at sea and ashore?
2. Training and Education. How can technology increase the effectiveness and stabilize the cost of training and education?

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3. Medical Care. How can technology provide medical care any time and any place in the emerging environments for naval operations?
4. Quality of Life. How can technology improve quality of life for sailors and marines at work, at sea, and at home?

The panel reviewed current practices and processes in these four areas and projected both requirements and candidate technologies that would enable naval forces to meet these requirements by the year 2035. The panel sought the best information available to help understand how activities in these four areas are accomplished now and how they are likely to be affected by emerging concepts of operations, human resource trends, and new technologies. The panel surveyed the current practices of major corporations and other non-Defense sources to see how human resources are managed in the non-Defense sector. Finally, the panel sought advice and information on trends and desirable outcomes for Navy and Marine Corps capabilities in these four areas of activity.

III. Background

A most difficult aspect of the panel's task involved "seeing over the horizon" -- anticipating developments and requirements that will be present in the year 2035. How might we have developed training for WW II before we fought WW I? How might we have prepared for the Korean War in, say, 1920?

Revolutionary breakthroughs are rare and by definition difficult to foresee. However, it is possible to extrapolate developments that are evolving from current technology and global trends. The panel sought to determine what might be done now to encourage the evolution of capabilities and practices that will ensure the effective and efficient acquisition and management of human resources that the Navy and Marine Corps will need to meet operational requirements in 2035. The panel specifically tried to identify areas where relatively small investments are likely to yield substantial returns.

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Some aspects of the operational environment likely to exist in 2035 could have a substantial impact on the development and management of human resources and are emphasized in the report. The panel assumed the following:

- o Our people will be inundated in technology and information.
- o Fewer people will be required or available for Navy and Marine Corps missions, but the investment in them will be greater. Individuals will have more training, autonomy, decision making responsibility, and military value.
- o Many operations will involve joint and/or multi-national forces. Our people will need to deal successfully with organizational and cultural diversity and to coordinate their operations with both military and civilian organizations.
- o Units will be dispersed, but most operations will require rapid task organizing and training preparation of forces. The Department of the Navy will require means to determine quickly and accurately the location and capabilities of units and individuals, and their specialized skills and knowledge.
- o Responsibilities for missions other than war (peacekeeping, peace imposition, disaster relief, counter-terrorism) will continue. These missions will require rapid, ad hoc preparations for unusual and unforeseen contingencies.
- o Biological and chemical threats will increase.

IV. Strategic Objectives

A. Eight Strategic Objectives

On the basis of these considerations and in response to its charge, the panel arrived at eight strategic objectives. Members of the panel believe that these objectives require and deserve

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CNO attention if our naval forces are to develop and maintain the human resources -- the human performance and competence -- they will need to meet the challenges of the 21st Century. The eight strategic objectives are the following:

- (1) Recruit a higher proportion of people with above-average abilities, including already trained people through lateral entry, and retain high performers for longer periods.**
- (2) Reduce the numbers of sailors required on ships and ashore and increase performance by investing in their professional development and personal well-being.**
- (3) Emphasize education for officers as an essential part of career development, especially education in Science and Engineering.**
- (4) Invest more in the conversion of conventional forms of training to technology-based, distributed training.**
- (5) Provide for significant advances in the development and application of medical technologies for reducing combat casualties and deaths.**
- (6) Establish a duty, career, and personal life environment that increases retention, enhances readiness, and promotes performance.**
- (7) Invest more in people-centered research to support the introduction of new technologies and to increase efficiency.**
- (8) Develop a more integrated system for managing people in response to advancing technologies, in order to increase efficiency and improve readiness.**

B. Discussion of the Strategic Objectives

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The following comments briefly describe and discuss the eight strategic objectives.

(1) Recruit a higher proportion of people with above-average abilities, including already trained people through lateral entry, and retain high performers for longer periods.

Personnel selection pays off. During the late 1970s, the Armed Forces Vocational Aptitude Battery (ASVAB) was misnormed³ so that the test scores of recruits were highly inflated. Because of this error about 30 percent of the recruits fell into the lowest acceptable category than the 5 percent being reported at the time. In the aftermath of the misnorming problem, Congress ordered the Services to validate the ASVAB as a selection advice using hands-on tests of performance. Based on the results of these new tests, an estimated \$3 billion across all of DoD was in lost productivity as a result of this inadvertent poor selection. Clearly continuing vigilance to maintain the validity of the ASVAB is necessary.

The Navy and Marine Corps, like all the services, take a bifurcated approach to recruiting. Most enlisted recruits are high school graduates, and most officers are college graduates or beyond. This model has served well in the past because most young people fell into one or the other of these two categories. In the future, however, this practice is likely to become increasingly problematic because more and more young people are graduating with Associate Degrees from community colleges. Currently the Department of the Navy recruits only about 400 of the more than half a million people who graduate with Associate Degrees every year. Navy and Marine Corps recruiters should consider expanding their presence in this large market of skilled people -- a market that is growing while the Navy Department's traditional market is decreasing. Policies and procedures, such as lateral entry, allowing individuals who possess advanced skills to enlist at advanced paygrades, or advance rapidly to them, should also be considered for this population.

³ Nord, R. and Schmitz, E. 1991. "Estimating Performance and Utility Effects of Alternative Selection and Classification Policies," The Economic Benefits of Predicting Job Performance. J. Zeidner and C.D. Johnson, eds., Volume 3, The Gains of Alternative Policies, Praeger Publishers, New York.

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Classifying people correctly into their job and career categories is also important. One study using Army test data⁴ found that the average predicted performance of soldiers could be more than doubled if these data were used to match people to jobs and military skill requirements.

Technology, particularly computer-based testing (using items that can only be presented by computer) can provide more comprehensive profiles of the interests, values, and abilities of individual recruits and may yield substantial returns in terms of increased retention and personnel readiness and reduced attrition and recruiting costs. These benefits are likely to be large and should be pursued by systematic programs of research and development in both selection and classification.

The current retirement system, which provides 100 percent vesting at 20 years of service but none before, skews the career lengths of a large fraction of the career force toward 20 years. As a result, some personnel stay too long, and others not long enough. A new system is needed that smoothes out the retirement incentives over a longer portion of the career. Furthermore, new late career retention incentives and modification to the mandatory retirement rules will be needed to encourage top performers to continue serving in the naval forces.

(2) Reduce the numbers of sailors required on ships and ashore and increase performance by investing in their professional development and personal well-being.

Fiscal restraints make it compelling that future ships be designed to operate with smaller crews, and technology investments should be made to achieve this in future ship classes. Reducing ship manning⁵ has the collateral benefit of reducing shore infrastructure by the amount of structure and overhead required to maintain current ship manning levels. “Outsourcing” and

⁴ Zeidner, J. and Johnson, C. 1989. The Economic Benefits of Predicting Job Performance, IDA Paper P-2241, Institute for Defense Analyses, Alexandria, VA.

⁵ The term “manning” is used as a convenient, generic shorthand for assigning personnel, male or female, to organizational and technical tasks within major systems and support bases.

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turning more work over to civilians will enable the Navy to achieve substantial savings while still getting necessary work done. The resources saved can be used to better support the remaining force and otherwise modernize Navy operations.

Since WW II the Navy has reduced the manning of warships -- by as much as two-thirds in some cases. However, there is an optimum mix of people and automation that needs to be established to optimize the cost effectiveness of operating warships. For example, some combat system departments have increased substantially in the past half century because of the addition of sensors, computers, and weapons that did not even exist earlier, whereas some engineering departments have experienced a 30% decrease in manning due to the substitution of gas turbine for steam propulsion.

There needs to be a total ship initiative that will produce the significant manning reductions that are required. The goal should be a greater than 50% reduction not only of ship manning, but also of the total infrastructure that supports the people on board ships. There are vast differences between Navy manning and its commercial counterparts. The Department of the Navy will have to adapt strategies from commercial practices using fewer but more experienced people to yield lower manning costs and higher readiness. Watch standing, damage control, maintenance and repair, and training all must be examined. The Department of the Navy should reduce the need for human monitoring and assessment of purely mechanical functions, eliminate excessive layers of supervision, and expand the concept of just-in-time manning.

The Navy should design ships for inherent resistance to damage, provide more automation for damage control, and provide better tools for repair parties. It should design ships for reduced maintenance and increased reliability; instrument for condition based monitoring using embedded diagnostics; provide vital equipment redundancy; and expand the concept of fly-in maintenance/repair teams, the use of digital maintenance manuals; and the use of just-in-time maintenance such as electronic performance support systems. Shipboard habitability and technology to increase quality of life aboard ship should also receive major consideration in the design of ships. The Navy should also explore the enhancement of human performance through the use of improved human-machine interfaces, including mind-machine communication.

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Finally, the Department of the Navy should elevate training to a position of importance equal to that of operations in systems design requirements and development. It should use embedded training and training on demand, provide continuous learning systems, and expand the use of adaptive training and job performance systems.

Life cycle costs, not just shipboard and acquisition costs, should be used as the measure of effectiveness in system trade-off studies. Senior management must lead the effort to determine the extent to which culture and tradition legacies are allowed to drive future ship manning.

(3) Emphasize education for officers as an essential part of career development, especially education in Science and Engineering.

Although it is commonly recognized both here and abroad that the real strength of the US educational system is at the graduate level, paradoxically there is little indication that Navy leadership prizes such education as a necessary component of an officer's educational background. The discipline in graduate study of tackling an original research problem that has no known 'right' answer, learning how to frame the question, how to attack it, how to interpret the data, how to draw significant conclusions from the data, and how to present and demonstrate the validity of the result provides an extraordinarily effective approach to problem-solving that is beneficial throughout a career. The nature of the discipline or the particular problem is less important than the process. The Navy does not value sufficiently the problem-solving potential represented in substantive graduate programs in technology, engineering, and science.

The needs of the Department of the Navy are not limited to what graduate education can supply. The rate of technological change substantially increases the need for officers with a strong undergraduate foundation in science, engineering, mathematics, or technology. It also increases the premium on technically capable and talented enlisted personnel.

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Naval force needs are now, and will increasingly become, highly advanced scientifically and technologically. The march of information and communication technology, sensing and display techniques, computer systems capabilities, material and power options, and other technically sophisticated capabilities has reduced routine shipboard manning requirements and improved warfighting strength. But these technical capabilities substantially increase the Navy's need for people able to analyze and choose among competing technological approaches, critically assess and lead technological development, and continuously formulate new technological visions.

Present Navy needs in science and technology may now be insufficiently met by its officer corps and its civilian laboratory personnel. Moreover, the gradient of the quality and quantity of naval force talents in technology, relative to mission needs, is not positive but negative. This trend limits the technical capacity of our naval forces today, and will increasingly isolate them from the technological growth and innovation that will be essential to sustained military effectiveness over the next 35 years. Some indications of this trend are the following:

- o The Navy no longer encourages or nurtures post-graduate technical education among its officer corps.
- o Fewer of the best US high school graduates opt for a Navy career, or college education in fields relevant to Navy technology needs.
- o Few students who are preparing in higher education for a Navy career, specialize in science, technology, or engineering.
- o Officers who specialize in science, technology, or engineering in their education, are less frequently provided post-graduate education, less rapidly promoted, and more likely to retire early.
- o Navy laboratory personnel, once nation-wide leaders in science and engineering, are now less prepared to meet important new Navy needs.

To supply the human performance requirements of naval operations in an increasingly technology intense environment the Department of the Navy will need to:

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- o Significantly increase the proportion of naval force officers who obtain bachelor degrees in science, mathematics, or engineering;
- o Ensure time in the career paths of all officers for post-graduate study in science and technology, and ensure that they are rewarded for their added skills and capabilities;
- o Restructure the mode of teaching science and technology at the US Naval Academy, with use of personnel on loan from major research institutions and industrial laboratories and/or the establishment of joint programs with research-based academic institutions;
- o Reconfigure promotion policies and practices to more fully reward and retain technically skilled officers and enlisted personnel;
- o Identify the most promising leaders, among those technologically educated, for special management talent recognition and fast-track movement to leadership positions that can benefit from their expertise;
- o Ensure a continuing stream of fresh talent employed in naval laboratories. Those who are retained in longer career paths should have regular opportunities to refresh their talents.

(4) Invest more in the conversion of conventional forms of training to technology-based, distributed training.

Education and training are key to developing and sustaining the levels of human performance needed by 21st Century naval forces. The effectiveness and efficiency of the Navy's education and training programs can be substantially improved through the application of instructional technologies. Investments in these technologies will yield significant returns that can be used to fill gaps that now exist in training delivery, further modernize training, and further increase its efficiency.

The most fundamental promise of technology applied to training appears to be its ability to tailor pace, sequence, content, presentation style, and difficulty to the needs of individual learners. Research suggests that the difference between those taught in classroom groups of 30 and those taught one-on-one by an individual instructor providing individualized instruction may be as large as two standard deviations in achievement. However, individual, one-on-one

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tutoring is prohibitively expensive. In military training as in civilian education, the provision of a single instructor for every student is an instructional necessity and an economic impossibility. Technology -- substituting the capital of technology for the labor of human instructors -- can replace some of the individualized tutoring, and its instructional value, that is now lost to economic necessity.

Comparisons⁶ of technology-based training with more conventional approaches have found that its use can raise student achievement by 15 percentile points, that it reduces time to reach given instructional objectives by about 30%, that it lowers training costs of training for equipment operation and repair by about 40%, and that students generally prefer it. It also makes training more accessible. Use of CD-ROM or newer Digital Videodisc (DVD) technology to provide training aboard ship and other dispersed locations can transcend residential classroom limitations of both time and place.

A natural application for technology-based training is in specialized skill areas. If 20% of Navy and Marine Corps specialized training students were to use technology-based training to reduce training time by about 20% the annual savings in training costs and student pay and allowances would amount to many millions of dollars a year. These economic benefits exclude the readiness improvements that might result from 20% earlier graduation of students from training.

Despite these promising indications, current use of these technologies in naval training is minimal. Available records indicate that of the 3,139 courses presented by the Navy in FY97, only 47, about 1.5 percent, used interactive instructional technology. An additional 49 courses were taught using videotraining to accomplish learning at a distance. Overall, technology-based approaches are unlikely to be found in more than 4 percent of all Navy and Marine Corps training. It is time to increase their use. Investments in these technologies are likely to increase substantially both the effectiveness and efficiency of training, to yield significant returns that

⁶ Fletcher, J.D. 1997. "What Have We Learned About Computer-Based Instruction in Military Training?" Virtual Reality, Training's Future?, R.J. Seidel and P.R. Chatelier, eds., Plenum Publishing, New York.

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can be used to fill gaps that now exist in training delivery, and to increase the pace of training modernization. Moreover, the technologies in question can collect data on individual and collective performance that could be used by local commanders in determining the composition of small teams.

Traditionally, budget decisions have tended to focus almost exclusively on the potential for savings within the operation and maintenance (O&M) accounts. There are O&M savings to be gained from investments in converting from current training approaches to those that are technology based, but there are significant additional payoffs to consider as well. These accrue from the reductions in student time needed to train when technology is used and the concomitant increase in time these individuals are available for duty. One difficulty is that although the investment needed to convert training programs will most probably come from O&M accounts, major savings will appear in personnel accounts, and not in O&M.

Outsourcing is a high priority concern within the DoD. Recent studies have found that costs to produce instructional materials and operate networked training simulations may be lowered, and fewer instructional personnel may be required for instructional delivery when outsourcing is used.^{7 8} Outsourcing cannot be applied universally in Navy and Marine Corps training, but it can produce significant economies in obvious areas such as specialized skill training or in the delivery of relevant education and training programs that are already available from community colleges and trade schools.

(5) Provide for significant advances in the development and application of medical technologies for reducing combat casualties and deaths.

⁷ Tighe, C. and Kleinman, S. 1996. Outsourcing and Competition: Tools to Increase Efficiency, Center for Naval Analyses, Alexandria, VA.

⁸ Metzko, J. 1996. Government vs Contractor Training at the US Army Signal Center, IDA Document D-1942, Institute for Defense Analyses, Alexandria, VA.

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When combat care is required, it is needed immediately and under the most stressful of conditions. It is urgently necessary in small contingency actions -- in the Lebanon- and Somalia-type operations that are likely to occur in the future and that allow little public tolerance for casualties. Combat care is also vitally needed in bigger wars, which will undoubtedly occur periodically. Over 55,000 Americans were killed in Vietnam, and a sample⁹ of Army and Marine casualties showed that over 50 percent of the wounded who died, died within 30 minutes. Further, as the current Gulf war medical debate illustrates, new weapons (chemical and biological) may be available to adversary nations for which new combat treatments are required. Combat care, and particularly urgent, battlefield care, should be given priority in DoD and Navy Department medical investments and in new technology development. Navy medical career patterns should be modified to emphasize the importance of capability and experience in combat medicine.

Many promising technologies under development or on the horizon could help improve combat and battlefield care. These include new types of protective clothing, providing greater protection against small arms fire or shrapnel and against chemical and biological threats. A range of new sensors will be available, such as advanced biochemical sensors and personal status monitors, some of which are implanted, that perform as personal black boxes, analogous to black boxes in aircraft. Protective clothing may incorporate some of these sensors and automatically administer physiologically protective agents as needed, along with some forms of medical care. Gels are being developed that can be applied directly to wounds on the battlefield, stop the bleeding, and increase the time available to save a person's life. Similarly, artificial white cells can be injected on the battlefield to help the body fight against chemical and biological attack. Other valuable technologies are emerging that will stabilize individuals against shock, enable a wounded person to remain inert but alive while waiting for transport to medical facilities, improve information and communications for deciding evacuation priorities, digitize medical records and provide integrated, interoperable medical databases, etc.

⁹ Carey, N.B., Rattleman, C.R., and Nguyen, H.Q. 1996. Information Requirements in Future Medical Operations, CAB 96-94, Center for Naval Analyses, Alexandria, VA.

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The Department of the Navy should support and accelerate R&D programs in combat medicine that integrate protection and monitoring systems; in at-sea medical systems using telemedical capabilities, and in advanced pharmaceutical products that are effective against new battlefield weapons.

The Department of the Navy should also enhance its combat medical capability through the development of a battlefield threat assessment and response system by supporting R&D in biotechnology that improve methods for early detection and identification, and that counter, prevent, or neutralize the adverse effects of chemical, toxin, or biological threats; counter nuclear and directed energy threats; and provide the means to reduce the risks from environmental hazards.

Finally, and most importantly, the Department of the Navy should place much more emphasis on the pursuit of combat medicine capability in its medical caregivers. It should reward those who specialize in combat medicine more fully in accord with its value to our naval forces and naval operations.

(6) Strive for a duty, career, and personal life environment that increases retention, enhances readiness, and promotes performance.

A recent study¹⁰ of the quality of life (QoL) in the Marine Corps demonstrated causal relationships between QoL and behavioral outcomes, including readiness, reenlistment intentions, and performance. These results support what military leaders have long believed, i.e., that QoL investments have an important payoff in desired military outcomes. Additional research is needed to track these investments, the scope of their implementation and use, and their impact on outcome measures. In many instances, the data required are collected but not made available. Means should be found to place them in data bases that can be used to inform decisions about QoL investments.

¹⁰ Kerce, Elyse W. 1995. Quality of Life in the US Marine Corps, TR 95-4, Navy Personnel Research and Development Center, San Diego, CA.

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Treating the following recommendations as priorities should help the Navy Department ensure an acceptable level of quality of life for members and families and, in turn, contribute to retention, readiness, performance of duty, and overall mission accomplishment:

- o Commitment and Community. Positive perceptions of Navy and Marine Corps life are critical in attracting and retaining qualified personnel, and QoL in duty-related life domains has an impact on morale and performance. The Navy Department should continue to facilitate commitment to the organization and a sense of connection to the military community by demonstrating concern for members and families through a range of QoL services. Innovative programs to build and foster commitment and community among Navy families, such as the US Marine Corps Family Team Building and Community Action Process initiatives should be encouraged. Privatizing the delivery of QoL benefits and services should be reviewed.
- o Workplace Characteristics. As new technologies reshape the workplace, the cognitive and sensory demands of complex tasks should not be allowed to exceed normal human capabilities or reasonable levels of stress. The Department of the Navy must maintain a watch for unintended consequences of technology in the workplace in order to take optimum advantage of its potential to enrich QoL and minimize the negative aspects of restructuring. Duty assignment is a critical QoL component, and it requires better matching of individual capabilities and preferences with job demands.
- o Communication. Separations due to training, operational deployments, and unaccompanied tours of duty are typically considered among the most difficult aspects of military family life.¹¹
^{12 13} The availability of improved communications technologies should be exploited to help

¹¹ Cooke, T.W., Marcus, A.J., and Quester, A.O. 1992. Personnel Tempo of Operations and navy Enlisted Retention, CNA Research Memorandum, Center for Naval Analyses, Alexandria, VA.

¹² Coolbaugh, K., and Rosenthal, A. 1992. Family Separations in the Army, US Army Research Institute for the Behavioral and Social Sciences, Alexandria, VA.

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deployed personnel deal with one of the major stresses of Navy life and to enhance QoL by providing opportunities to maintain closer contact with families and other loved ones. Leaders must learn how to manage the use of these inevitable communication technologies without compromising the security of the mission or the well-being of the service member.

- o Professional growth. Because of the skills and skill levels required, and in order to protect its education and training investment, the Department of the Navy must increasing stress retention. Its population will consist of a greater percentage of career personnel who are both better trained and older than today's force. In general, higher educational levels engender greater expectations, which in turn will emphasize the importance of QoL in both the duty and personal life domains. The Department of the Navy must provide for the growth of military professionalism among both enlisted and officer personnel.
- o Research and analyses. Regular, systematic assessment of QoL should be established and routinized. Available technology and information systems can be used effectively and efficiently to build centralized demographic data bases that can be combined with other data to answer questions about the utility and cost-effectiveness of QoL programs. The results of these efforts should be applied to allow policy makers to make more informed decisions about programs based on their utility and their contributions to mission accomplishment. Results of these efforts should also be used to strike a proper balance overall between resources allocated to QoL programs and those allocated to meet other Navy Department needs.

(7) Invest more in people-centered research to support the introduction of useful new technologies and increase efficiency.

A substantial number of new technologies will become available over the next several decades to improve the way the Navy makes the most of its human resources. Understanding the strengths and weaknesses of these technologies, and the cost-effectiveness of different

¹³ Segal, M.W., and Harris, J.J. 1993 What We Know About Army Families, US Army Research Institute for the Behavioral and Social Sciences, Alexandria, VA.

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approaches for using them, should be high-priority research objective. Otherwise, technologies that could enable more effective use of naval force human resources may be applied in a piecemeal and less efficient way. Research into the cultural and organizational implications of technological change will also be important, as these factors are at least as significant for effecting change as the technology itself. Systematic review of the understanding of human cognitive processes, limitations, and workload constraints should be part of this research agenda. Periodic full-system analyses will also be useful in order to understand the interaction among technologies and the trade-offs among the various means for developing and maintaining human productivity.

Research in performance enhancement, training and education, and QoL -- especially applied research to help organizations make rational choices among technologies and facilitate their adoption -- appears to be limited. Data about the research investment in this area is hard to come by; but it appears to be small. For example, in FY1996 the Department of the Navy invested only \$29 million in the two Congressional categories of (people-centered) research relevant to training (Education and Training, and Simulators and Training Devices), when the amount spent by the Navy Department on residential training for individuals, excluding the amounts spent on field and fleet training, was over \$5 billion. Also in FY1996, Navy Department spending on all human resource research was about \$86 million for a military workforce account of over \$23 billion. This is an area the Navy might wish to examine further, with the aim of developing an overall investment plan; the return on this research investment could be substantial.

(8) Develop a more integrated system for managing people in response to advancing technologies, in order to increase efficiency and improve readiness.

Many components combine to produce the human resources -- the human competence -- needed by the Navy and the Marine Corps. These include recruitment, selection, classification, assignment, training, and job design (which includes ergonomic design of equipment and use of job aids or performance support systems). All these components are interdependent. If they are managed as independent, 'stove-piped' entities, their interactions will not be accounted for and

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improvements sought in one component may be overwhelmed by consequences they create elsewhere. For instance, self-paced instruction provided by the training system will be of little value if the personnel system can not cut orders for varying graduation times or provide rewarding assignments to those who finish early. Alternatively, issues seen as problems in one component may be better resolved by investments in another. For instance, issues treated as training problems may be better resolved through adjustments in classification or job design. Studies have found that the Air Force Integrated Maintenance Information System (IMIS), which provides just-in-time advice to maintenance technicians, can reduce training and selection requirements. Implementation of IMIS provides another instance in which one budget category (acquisition or operations) must pay for an investment whose returns are found in another budget category (personnel). It also illustrates well the need to better understand system-wide, cost-effectiveness tradeoffs among selection, training, and job-aiding.¹⁴

The full human resources system must be taken into account. Investments in personnel selection, classification, assignment, training, job design (including the ergonomic design of equipment) should be balanced and coordinated to optimize returns in readiness and force effectiveness. The key may be to view the provision of mission-ready, competent human performance as the goal, rather than seeking isolated improvements in training, selection, human factoring, or other essential but subsidiary components of the system.

Developing and maintaining a systems view of human performance or human resources will require both cultural and organizational changes and research as well as research and analyses of the system-wide costs and effectiveness of different approaches. Organizationally there needs to be a DoN focal point where all aspects of human resources are routinely considered together as an interacting system.

Moreover, personnel research and analyses are needed to assess interactions and trade-offs and address gaps in management of Navy readiness. They should include ongoing, high-level

¹⁴ Teitlebaum, D. and Orlansky, J. 1996. Costs and Benefits of the Integrated Maintenance Information System (IMIS), IDA Paper P-3173, Institute for Defense Analyses, Alexandria, VA.

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review of our understanding of human cognitive processes, limitations, and workload constraints. This review should be used to inform policy decisions about human resource management, design of weapons systems, and operational doctrine. Research and analyses of this sort are not expensive. Currently the ratio of research money invested in human resource issues relative to the amounts spent on human resources is less than one-half of one percent. It may deserve to be increased. The payoff will exceed the required investment.

V. Final Word

It should be recognized that human competence is essential to every Navy and Marine Corps operation. Its presence will not guarantee the success of these operations, but its absence will most certainly ensure their failure. The availability of human performance at the highest practicable levels of competence is a matter of the first importance to the Department of the Navy. Investments in human resources that are modest compared to other areas will yield substantial returns. They should be treated as significant issues that deserve both priority and given high-level attention.

Technology for Future Naval Forces 2000-2035:
Human Resources

J.D. Fletcher
Institute for Defense Analyses

Terms of Reference:

“A thorough examination of the impact of advancing technology on the form and capability of the naval forces to the year 2035.”

Identify “present and emerging technologies ... with specific attention to

- (1) Information warfare ...
- (2) Mine warfare and submarine warfare ...
- (3) Navy and Marine Corps weaponry ...
- (4) Issues in caring for and maximizing effectiveness of Navy and Marine Corps human resources.”

Nine Panels:

- o Technology
- o Human Resources
- o Information and Warfare
- o Logistics
- o Modeling and Simulation
- o Platforms
- o Technology
- o Undersea Warfare

0 Weapons

Human Resources Panel: Four Areas

- o Manpower and Personnel
- o Training and Education
- o Medical Care
- o Quality of Life

Background Assumptions (I)

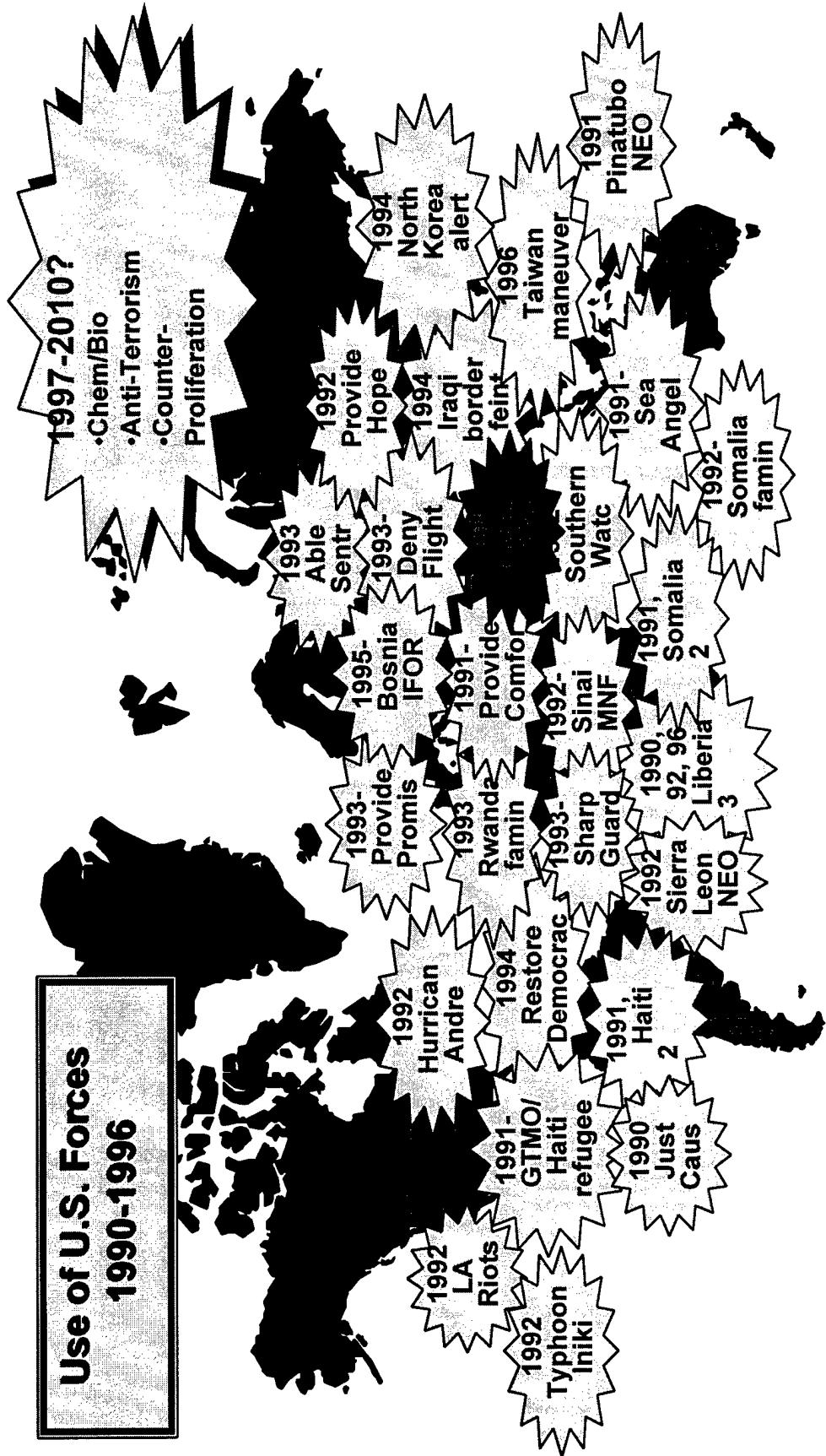
- o Service personnel will be inundated with technology and information
- o Fewer people will be required or available, but the investment in them will be greater -- more training, autonomy, decision making responsibility, and military value
- o Many operations will be accomplished with joint and/or multicultural forces

Background Assumptions (III)

- o We will depend on dispersed units that require rapid task organizing and training preparation
- o Responsibilities for missions other than war will continue
- o Biological and chemical threats will increase

Trained and Ready for What? Future Missions Like the Recent Past -- and More

Use of U.S. Forces 1990-1996



Strategic Objective #1

- o Recruit a higher proportion of people with **above-average abilities**, including already trained people, through lateral entry and retain high performers for longer periods

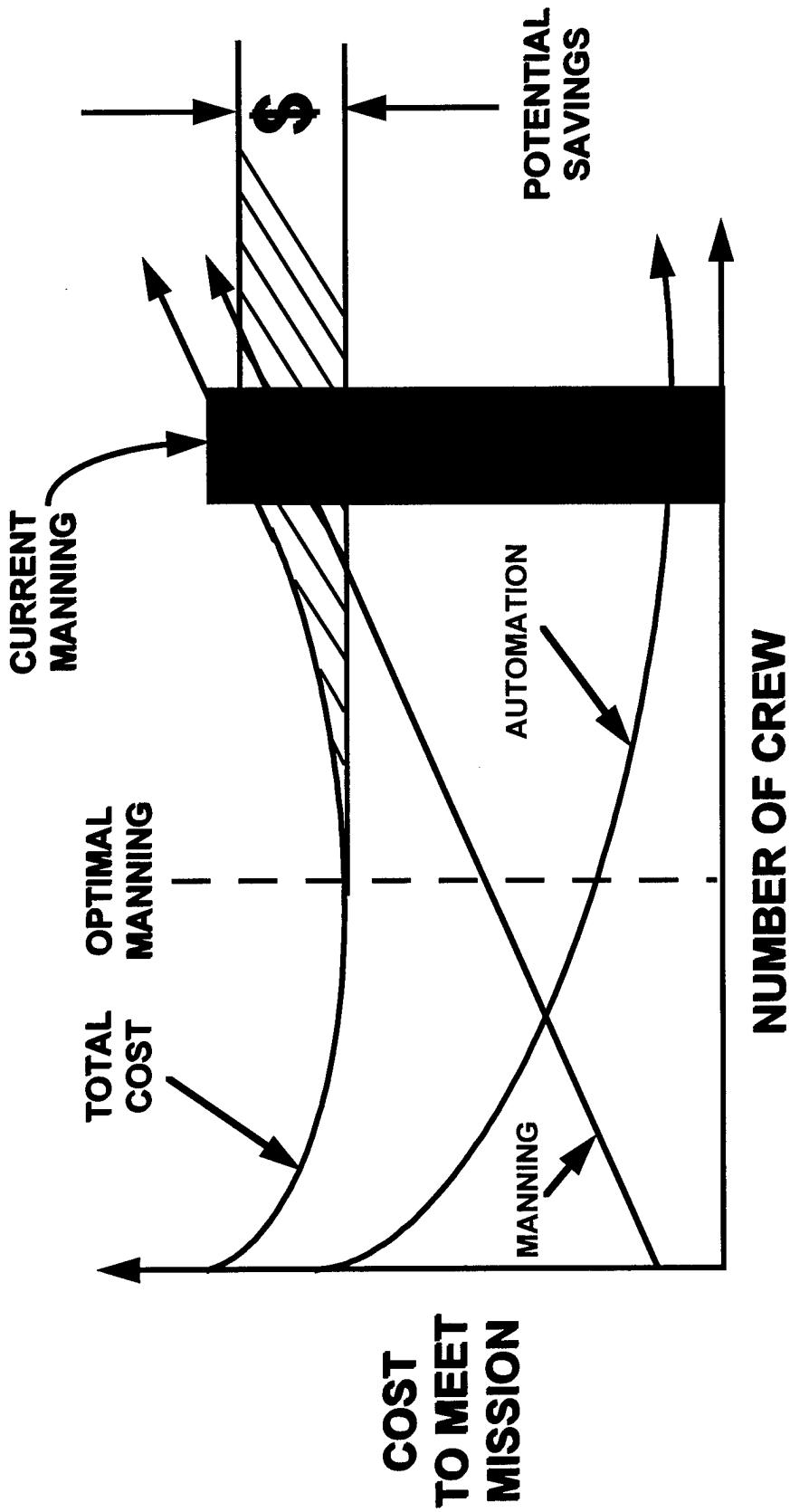
Investment in the following will pay off:

- Personnel selection
- Personnel classification
- Community college recruiting
- Lateral entry
- Technology for personnel management
- Revised retirement system

Strategic Objective #2

- o Reduce the number of sailors required on ships and ashore and increase performance by investing in their professional development and personal well-being
 - 50% manning reduction on ships and in the infrastructure to support ship manning through review of policies and procedures for:
 - Watchstanding
 - Damage control
 - Maintenance and repair
 - Training
 - Use life-cycle costs as the measure of effectiveness in system trade-offs

SHIPBOARD MANNING



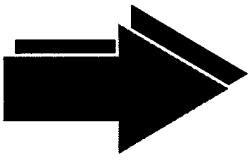
CULTURE AND TRADITION BENCHMARKING

USN

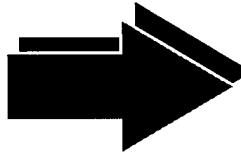
- EXCESSIVE SUPERVISION
 - EOOW WATCHES PAC, EPCCE, DCCO
 - OOD AND JOOD
 - “WATCH SUP” IN CIC
 - MESS DECKS MASTER AT ARMS
 - LPO’S AND LCPO’S

COMMERCIAL/NON-USN

- EXCESSIVE SUPERVISION
 - MINIMAL SUPERVISION
 - HIGH SKILL AND EXPERIENCE LEVELS FOR TASKS
 - HIGH AVERAGE YEARS OF EXPERIENCE FOR ALL PERS



**FEWER BUT MORE
EXPERIENCED PEOPLE
PROVIDES LOWER COST AND
HIGHER READINESS. (CNA
PROFESSIONAL PAPER 425:
COSTS AND BENEFITS OF
TRAINING AND EXPERIENCE)**



**ASSUMES ALL JUNIOR
MEMBERS OF THE TEAM MUST
BE CONSTANTLY WATCHED**

Strategic Objective #3

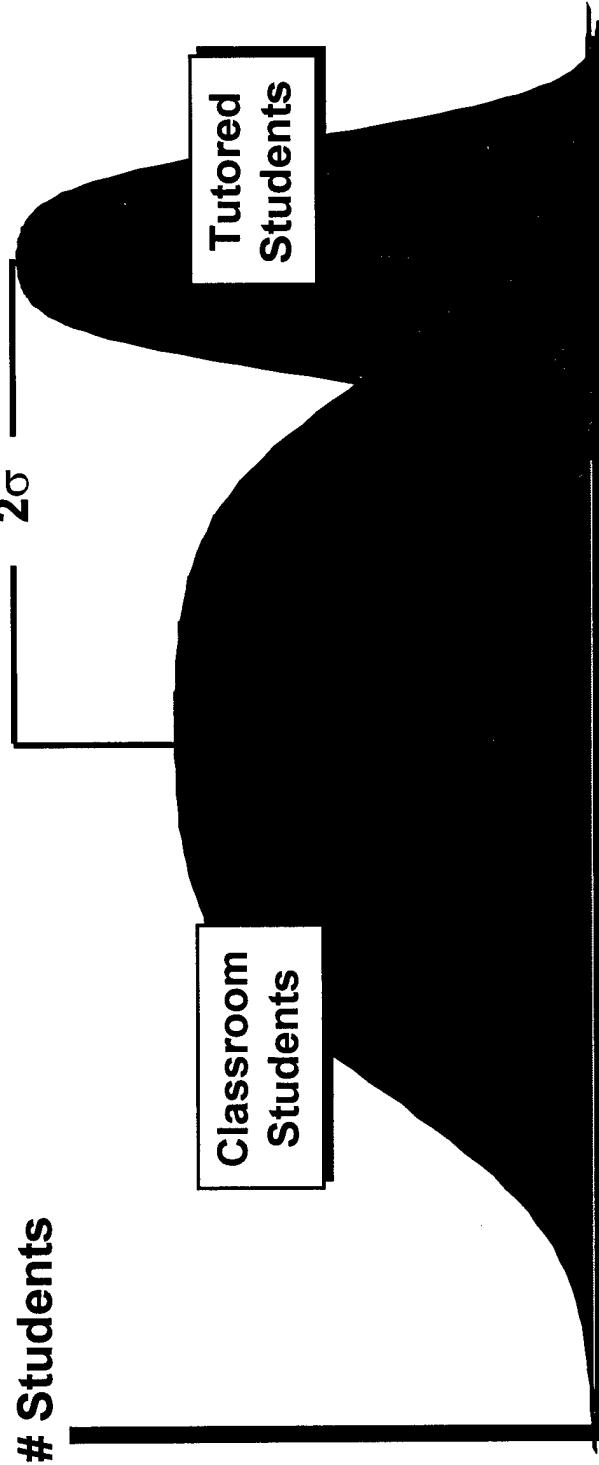
- O Emphasize education for officers as an essential part of career development, especially education in science and engineering**
 - Increase the proportion of officers with degrees in science, mathematics, or engineering
 - Ensure time in career paths for post-graduate study in science and technology and reward those who add skills in these areas
 - Reconfigure promotion policies accordingly for both officers and enlisted personnel
 - Revitalize Navy laboratories with continually refreshed talent

Strategic Objective #4

- o Invest more in the conversion of conventional forms of training to technology-based, distributed training
- Current infusion of technology is minor
- Individualization as “an instructional imperative and economic impossibility” now made possible through technology
- Reductions in manpower costs through technology are very likely, but O&M must make the investment

Individualized Learning is Effective

ON AVERAGE, TUTORED STUDENTS SCORE BETTER THAN 98% OF CLASSROOM STUDENTS - A 2-SIGMA SHIFT



Achievement

Adapted From: Bloom, B.S. The Two Sigma Problem: The Search for Methods of Group Instruction as Effective as One-to-One Tutoring. *Educational Researcher*. 13,4-16 (1984)

**Potential Savings (Cost Avoidances) from Recovered Personnel
Pay and Allowances Due to the Introduction of Technology in
Navy and Marine Corps Specialized Skill Training (\$M)**

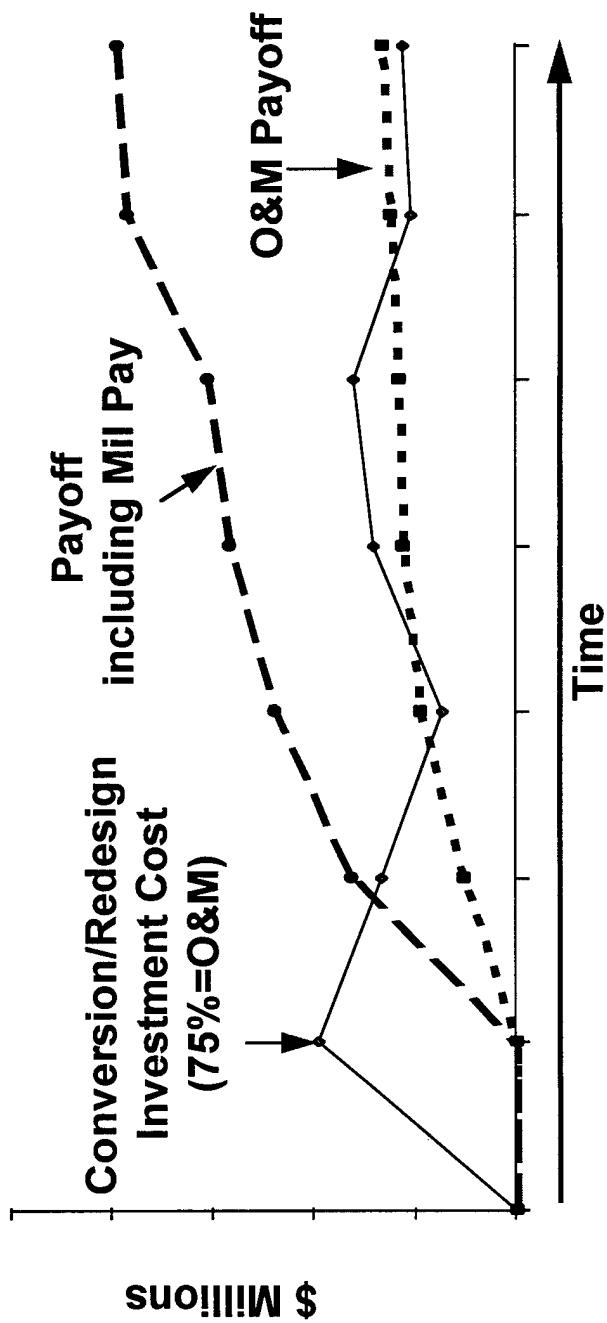
	Percent Training Load Covered		
	20%	40%	60%
Percent	31	63	94
Time	47	94	142
Saved	63	126	189
			252

**Potential Savings (Cost Avoidances) in Training Costs Due to
the Introduction of Technology in Navy and Marine Corps
Specialized Skill Training (\$M)**

		Percent Training Load Covered		
		20%	40%	60%
Percent	20%	30	59	89
Time	30%	44	89	133
Saved	40%	59	118	177
				236

Future Training Initiatives: Invest in More Efficient Individual Training

Significant Course Conversion Investments
to Leverage Current Learning Technologies



Strategic Objective #5

- o Lead in the development of medical technologies for reducing combat casualties and deaths
- Employ new technologies for better protection and monitoring
- Concentrate R&D on battlefield threat assessment and response
- Increase emphasis on and reward of specialization in combat medicine

Strategic Objective #6

- o Establish a duty, career, and personal life environment that increases retention, enhances readiness, and promotes performance
- Foster commitment and community among Navy and Marine Corps families
- Maintain a watch for unintended consequences of workplace technology
- Use technology to improve communications between deployed personnel and their families

- Encourage the growth of professionalism for officers and enlisted personnel
- Establish routine quality of life assessment

Strategic Objective #7

- o Invest more in people-related research to support the introduction of new technologies and to increase efficiency
- Current spending on people-related research is small:
 - (about \$29M for \$5B in residential training = 0.6%)
 - (about \$83M for a \$23B workforce = 0.4%)
- Research will increase our understanding of the cost-effectiveness and military value of emerging technology in
 - (a) Improving and human performance
 - (b) Facilitating training and education
 - (c) Improving quality of life

Strategic Objective #8

- o Develop a more integrated system for managing people in response to advancing technologies, in order to increase efficiency and improve readiness
- Need for a DoN focal point for full-systems human resources management, i.e., management of all trade-offs among our means to develop and sustain human competence and systems productivity

Final Word

- o Human competence is essential to every Navy and Marine Corps operation
- o Investments in human resources yield substantial, cost-effective military value
- o Investments in human resources should be treated as significant issues and given high-level attention

The URL for this NSB report is:

<http://www2.nas.edu/nsb/tfmf.htm>

The Future of Educational Technology in Retrospect

Raymond S. Nickerson

Tufts University

About 10 years ago, a colleague (Phillip Zodhiates) and I organized a conference on Technology in Education, in which the conferees were asked to speculate on how technology might impact education during the coming 30 years or so. The conference was sponsored by Harvard University's Educational Technology Center, the funding for which came from a variety of sources, but primarily from the U. S. Department of Education. The idea of the conference was that of Judah Schwartz and Charles Thompson of the Center. Participants in the conference, in addition to the organizers, were William Bossert, David Cohen, Andrea DiSessa, Wallace Feurzeig, Howard Gardner, Thomas Landauer, Shirley Malcom, Jim Minstrell, Roy Pea, Lauren Resnick, Alan Shoenfeld, and Elliot Soloway. The papers from the conference were published as a book with the title Technology in Education: Looking Toward 2020.

The assignment that I accepted for this conference was to take a retrospective look at the vision of the near-term future of technology in education that I tried to articulate in that book, to consider it in light of developments over the ensuing 10 years, and attempt to say how such a vision might be different if articulated today. To put the 2020 exercise in a broader frame of reference, I will begin with some comments about the advance of information technology over the last few decades.

The revolutionary nature of progress in information technology

The term "revolutionary" is much overworked, but I think there is no better way to refer to what has happened in information technology over the last half of this century. By information technology, I mean computer technology, communication technology, and, especially, computer and communication technology in combination.

We have become so accustomed to rapid change in this area to cease to be surprised by it. Embedded, as we are, in the ongoing revolution, it is difficult to back off enough to get an objective look at it, and to make sense of what it all means for the future. I want to remind us of the truly remarkable pace of change in information technology by making a number of comparisons.

• In the early 1960s, the Air Force laboratory where I worked at the time (the Decision Sciences Laboratory at Hanscom Field) acquired a PDP-1 computer (I believe it was the fourth computer that DEC built) to be the work horse of a psychological laboratory. This machine occupied 17 square feet of floor space, and required special air-conditioning. It boasted 4096 18-bit words of RAM (expandable to 65,536 words) and a memory-cycle time of about 5 microseconds. Because it took two cycles to do an addition, it could do 100,000 additions per second. Secondary storage was punched paper tape, which could be read into memory at a speed of 400 lines (about 133 words) per second. It cost on the order of \$100,000, which is closer to \$500,000 in 1997 dollars. It came with no applications software and had to be programmed in assembly language. Those of us who got to use this machine thought it was absolutely amazing. We could use it only one at a time, of course, but we scheduled it around the clock. I remember sitting in front of its console many many nights, trying to get it to do my bidding, and sometimes even succeeding. The least expensive and least powerful desk-top or lap-top computer on the market today has more capacity, by many orders of magnitude and comes equipped with software about which we could not even dream.

• The rapidity of the advance of computer technology during the last several decades can be highlighted in many ways. A particularly striking one involves the cost of a logic gate, which decreased by about five orders of magnitude over three decades, going from about \$10 in 1960 to about \$0.0001 in 1990.

These comparisons are based on a time window several decades wide, but one can get a sense of the rapidity of change even from comparisons over much smaller periods.

• When I retired from Bolt Beranek and Newman in 1991, I purchased a desk-top computer that was state of the art at that time. Five years later, it was possible to buy a machine with 16 times as much RAM, 25 times as much hard disk capacity, 6.5 times its processing speed, assorted additional capabilities (e.g., CD ROM, sound), at about 75 percent of its cost (probably closer to 50 percent in constant dollars). I keep putting off replacing my antique, in part because it continues to serve me very well, and in part because the technology is moving so rapidly that I am always tempted to wait for a still better option that is always just about to become available.

This remarkable rate of progress was made possible, in large measure, by the great success of efforts to reduce continually the amount of matter and energy required to store and move a unit of information. The following table is an extension of one published by Miller (1965) thirty years ago to compare the efficiency of cuneiform tablets, paper, and magnetic tape in terms of the amount of information they could carry per unit of matter. To his estimates I added a couple more to bring the progression up to date. The estimate for the CD Rom comes from weighing a 500 megabyte disk on a postage stamp scale. That for 3-D optical comes from experimental work described by Parthenopoulos and Rentzepis (1989) involving a device that has a theoretical maximum capacity of 6.5×10^{12} bits per cubic centimeter, and an estimated weight of a cubic-centimeter device of between 1 and 10 grams. (10^{12} bits is roughly equivalent to 100,000 sizeable books, not counting pictures.)

Matter cost of information storage (order of magnitude bits/gram)

Cuneiform tablets:	10^{-2}
Type on paper:	10^3
Electronic tape:	10^6
CD Rom:	$10^8 - 10^9$
3-D optical	$10^{11} - 10^{12}$

The implications of miniaturization on this scale are brought into relief by a comparison of opinions of two experts regarding what might be possible by way of simulating a human brain. The opinions were expressed in articles that appeared in Scientific American about 45 years apart.

- In 1949 George Gray, citing Warren McCulloch as the source of his estimates, noted that "if a calculator were built fully to simulate the nerve connections of the human brain, it would require a skyscraper to house it, the power of Niagara Falls to run it, and all the water of Niagara to cool it." In 1994 Marvin Minsky, noting that the brain is now believed to contain on the order of 100 trillion synapses, speculated that "[s]omeday, using nanotechnology, it should be feasible to build that much storage space into a package as small as a pea."

Minsky was not saying that a pea-sized simulation of the brain is possible with today's technology, but the fact that such a feat is considered feasible in the foreseeable future is remarkable, and it could hardly have been imagined even as a remote possibility 45 years ago.

The unanticipated rate of progress

What has happened in computer technology over the last several decades was, for the most part, unanticipated. It is easy to find predictions that were made by knowledgeable people at about the time computers were becoming commercially available to illustrate woefully inaccurate expectations. A story that I have repeated on occasion is one told by Lord Vivian Bowden (1970), who, in 1950, was asked by Ferranti (which had just built a computer and was the first commercial company in England to do so) to determine whether it would be possible for a commercial firm to manufacture such machines and sell them at a profit.

I went to see Professor Douglas Hartree, who had built the first differential analyzers in England and had more experience in using these very specialized computers than anyone else. He told me that, in his opinion, all the calculations that would ever be needed in this country could be done on the three digital computers which were then being built -- one in Cambridge, one in Teddington, and one in Manchester. No one else, he said, would ever need machines of their own, or would be able to afford to buy them. He added that the machines were exceedingly difficult to use, and could not be trusted to anyone who was not a professional mathematician, and he advised Ferranti to get out of the business and abandon the idea of selling any more of them (p. 43).

Within twenty years of the time of Hartree's pronouncement, seventy companies were producing over 370 models of these machines.

Expressions of other opinions equally off the mark can be found in Cerf and Navasky's The Experts Speak: The Compendium of Authoritative Misinformation. I will mention a couple.

- I think there is a world market for about five computers. (Attributed to Thomas J. Watson, IBM's chairman, in 1943.)
- There is no reason for any individual to have a computer in their home. (Kenneth Olson, founder and president of DEC, at the Convention of the World Future Society in Boston in 1977.)

As of 1993, 51,000,000 Americans (46 percent of the total labor force) were using computers on the job (Bureau of the Census, 1996, Table 657). As of 1995 there were an estimated 257 million computers in the world, and that number was expected to double by 2000. In the United States, the number of computers per 1000 people went from about 90 in 1985 to about 365 in 1995. By 2000 there are expected to be more than one computer for every two people in the U. S. and about 90 per 1000 people worldwide. In all of these counts, the vast majority of computers are micros or PCs; for the 1995 figures, they account for about 95 percent of the total (Johnson, 1997, pp 566, 567).

With the advantage of hindsight, it is easy to ridicule opinions that proved to be grossly off the mark, but to see them as unusual or as evidence of lack of perceptiveness on the part of those who held them would be a mistake. I doubt if what has happened was anticipated even by the most insightful visionaries.

J. C. R. Licklider is among those who come most quickly to mind when I think of extraordinarily articulate and influential visionaries. His paper on man-computer symbiosis (1960) was a classic, and his numerous other writings in this area framed challenges that would stimulate research and development for many years. But I don't believe that in his most speculative writings he foresaw the kind of computing power that developments in miniaturization technology would put on peoples desks before the end of the century. In his Libraries of the Future, published in 1965, the prevailing conception was that of large computers serving remote users via time-sharing; the possibility that in the foreseeable future individuals would have enormous amounts of computing power locally had not yet surfaced as a plausible idea.

It would be very easy to continue in this general vein, illustrating the great rapidity with which information has advanced and bolstering the claim that this rate of advance was anticipated by very few people, if by anyone at all. But I suspect that these points are not very controversial and that, on reflection, most people will agree with them.

Communication technology and networking

Progress in computer technology has been accompanied by comparable advances in communication technology and a merging of the two technologies, especially in the emergence of computer networks, to the point that it is almost impossible to talk of them as separate entities.

The first major computer network, the ARPAnet, began as a four-node system in 1969; its successor, the Internet, connected an estimated 4.8 million hosts computers, worldwide, as of 1995, according to a report in a special issue of Time on Cyberspace (Elmer-DeWitt, 1995). The

number of individual users of the Internet, and other major networks, appears to number in the 10s of millions and to be growing at a still-increasing rate. Traffic on the NSFnet backbone of the Internet increased 100-fold between 1988 and 1994, and as of 1994, traffic on all federally funded networks and the number of new local and regional networks connecting to them was doubling annually (OSTP, 1994).

To me the most important consequence of what has happened in information technology over the past few decades, and the probable future progress of this technology, is the great increase in information accessibility that it represents. The combination of very wideband networks of enormous-capacity supercomputers, connecting terminals with high-quality displays and large amounts of local computing power, and smart software will give the average person unprecedented access to information and information resources of every conceivable kind. The World Wide Web is rapidly becoming the medium of choice for information acquisition and dissemination for increasing numbers of people. This fact was punctuated, as these words were being written, by Judge Hiller Zobel's announcement of his intention to reveal his decision, in the controversial Louise Woodward case, which captured worldwide attention, by posting it on the Internet.

I have argued elsewhere (Nickerson, 1986) that over the history of humanity there have been several quantum jumps in the accessibility of information and that each has radically changed the future of the species. The development of written language constituted one such jump, the invention of movable type and the printing press constituted another. I think it likely that what has happened, and is happening, in information technology -- especially the implementation of worldwide computer networks that that has enabled -- is another such jump, the ultimate effects of which we can now only dimly see.

The contrasting rate of change in education and training

When we consider what has happened in education and training over the past several decades, and, in particular, what impact information technology has had in these areas, a very different picture emerges. In this case, the impression is that not very much has changed, or that nothing has changed very much. Ten years ago, the situation was described in the 2020 book this way. "The possibility of using computers and related technology for instructional purposes has been of interest to some researchers and educators for at least two decades. Early hopes for computer assisted-assisted have not been realized, however, and the impact of technology on instruction and learning has not been great" (Nickerson, 1988b, p. 7). I fear the situation has not changed much in this respect in the ensuing years. Or, if it has, I have not seen the evidence of it.

Despite a great deal of enthusiasm for what appeared to be the promise of computer-assisted instruction as early as the 1960s, and a considerable amount of substantive work on the development of manipulable microworlds, simulated laboratories, intelligent tutoring systems, and the like, as well as the development of numerous commercially-available programs designed to teach specific subject matter -- or facilitate learning by exploration and discovery -- today's classrooms look remarkably like those of mid-century and the evidence that students generally learn more, better, or faster is not abundant.

A ten-year-old vision of the future of technology in education

In what follows I draw primarily from the introductory and concluding chapters of the 2020 book. I wrote those chapters, but my thinking, especially as reflected in the concluding one, was very much influenced by the papers of the various contributors and by the discussions that occurred during the days of the conference.

The following is a list of short-term trends that were mentioned in the introductory chapter as being "easy to see" and highly relevant to education ten years ago.

- The speed of the devices used for computing and for storing information will continue to increase, while their size, power requirements and cost will continue to decrease.
- Computer systems that realize orders of magnitude increases in computing power by exploiting parallel multi-processor architecture will become increasingly common.
- Remote wireless terminals will provide access to computer networks and thereby to central repositories of information of nearly every conceivable type.
- Microprocessor-based computing power will be everywhere -- in household appliances, in hand tools, in games and toys, in clothing.
- Software will be available for an increasingly extensive array of applications and much of it will have potential for serving educational purposes.
- Software also will be developed that will permit the supplementation of conventional text with dynamic graphics, including process simulations, that should enhance the effectiveness of expository material.

- Multimedia communication facilities, allowing the mixing of text, images, and speech will become widely available.
- User-oriented languages and "front ends" to applications software will become increasingly easy for people without technical training to use. How soon truly natural-language capabilities will be available is difficult to say; however, systems with useful aspects of natural language and limited speech input and output capabilities will proliferate.
- Computer-based information services addressed to a diversity of objectives -- job posting, want ads, selective news, information searches -- will also proliferate.
- Increasingly powerful tools to facilitate interacting with very large data bases -- both for directed searching and for browsing -- will be developed.

Most of these expectations have been realized to some degree during the past ten years, which is not surprising, because they were hardly radical when they were stated. Progress has been slower in some instances than in others, but it has been made in all cases, and I think we can expect more of the same over the near-term future.

Ways in which technology could enable significant educational change

In the final chapter of the 2020 book there is a list of some of the ways in which it then appeared that technology -- interpreted sufficiently broadly to include new scientifically derived knowledge -- could enable significant educational change over the coming few decades. This list was composed after the conference and drew heavily from the conference papers and discussions at the conference sessions. It is reproduced here in abbreviated form.

- A very large amount of software will exist that was developed for educational purposes -- microworlds, electronic exploratoria, programs with both tutorial and exploratory capabilities.
- Expert systems will be used extensively in the business world; much knowledge that constitutes domain-specific expertise will have been codified.
- Wideband two-way communication channels linking homes to information resources of various types will be a reality. Perhaps too there will be software that will facilitate the effective tapping of these resources.

- Electronic pocket fact finders may exist that will provide answers to encyclopedic questions on request.
- There will be electronic books that can not only present conventional text, but also definitions, explanations, maps, simulations, answers to questions regarding the book's contents, and so on.
- Super courses probably will have been developed by pooling the capabilities and techniques of the best teachers, augmented by access to a wide assortment of resources and information manipulation tools.
- There should be classrooms without walls, in which students in different locations can interact as a learning group.
- There may be much more effective techniques for assessing knowledge and abilities -- of probing depth of understanding and identifying misconceptions.
- Perhaps there will be effective techniques for distinguishing between problems arising from lack of knowledge and those stemming from faulty reasoning.
- There should be better models of conceptual difficulties commonly encountered by students at specific levels of mastery of a subject.
- Perhaps there will be a better understanding of the determinants of intellectual competence.
- Perhaps principles of learning will be better understood.
- The roles that metaphors play in learning -- both beneficial and detrimental -- may be understood better.
- Perhaps more will be known about how to communicate effectively and how better to cooperate toward common goals.

The perceptive reader will note, no doubt, that the "predictions," if one can call them that, become somewhat softer and more iffy as one gets closer to the bottom of the list.

As I look the list over, it seems to me still to be a reasonable one in the sense that most of these expectations should be realized to a significant degree within a couple of decades or so.

Progress has been made on many of them over the past ten years, although it is more obvious in some cases than in others.

Why has technology had so little impact on education to date?

Schools have been acquiring computers. The percentage of elementary and secondary schools in the United States that have micro computers for standard instruction went from 77.7 in 1985 to 97.5 in 1994, according to Bureau of the Census (1996) statistics; the ratio of students-to-micros went from 63 to 11 during the same time (Table 261). Counting micros and terminals to larger systems, the percentage of elementary and secondary schools using computers for instruction went from 86 in 1985 to essentially 100 by 1992 (Table, 262).

Despite these figures, which tell us little about what this all means for the average student, there is not much evidence of widespread dramatic change in either approaches to teaching or the effectiveness of schooling as revealed in student performance on standardized tests. Perhaps it is too soon for much change resulting from the use of computer-based educational tools to have occurred. On the other hand, given the fact that there were none of these tools in schools a few decades ago and now there appear to be at least some of them in essentially all elementary and secondary schools, it seems reasonable to expect to begin to see compelling evidences of their effectiveness. Why has it not been forthcoming more rapidly?

Is it because the software that has been developed is simply not as good as it must be to be useful in the classroom? There is a great difference between a prototype program that works well in the hands of knowledgeable developers and one that will be successful in the classroom. Is it because of institutional or political resistances to change? Is it because of the piecemeal nature of what technology is offering?

I suspect that all of these possibilities factor into the mix to one or another degree. But I suspect too that a major problem is one to which Bossert called attention in his chapter in the 2020 book: "Those whose attention we seek in our attempts to further the applications of technology in improving education have every right to be suspicious of us. Throughout the history of computer-aided instruction, or educational technology as we now call it to wash ourselves of past sins, they have been sold ideas without products, products without curricula to which they may be applied, and curricula developed without regard for the institutional constraints of an overall educational policy. We have regularly put the cart before the horse by developing technology first and searching for educational problems that might be relevant to the advance" (Bossert, 1988, p. 275).

I believe that the point that Bossert makes here is a very important one and identifies a major impediment to the effective application of computer technology in the classroom. It points up the need for a much closer collaboration between technologists and educators than has occurred in the past. Certain aspects of any subject lend themselves more readily to computer-based instruction, or computer-based learning, than do other aspects of the same subject. It is only natural for the technologist to focus on the latter and to build systems to teach, or facilitate the learning of, them. But this leaves the teacher with the problem of figuring out how the relevant systems or bits of software that have been developed can be integrated with the other material and approaches that he or she is using so as to provide a coherent treatment of the subject for the class. Some teachers can do this, but many, especially those who have had little experience with computers, cannot. The promotional information that they see in catalogues and other marketing instruments is not much help in this regard.

In keeping with this line of thinking, one of the main conclusions that was drawn from the 2020 conference was that "What is needed are some serious attempts to develop curricula and instructional approaches for entire courses taking into account that educational technology exists. The question should not be: What aspects of physics, say, can we best teach using a computer; the question should be: How can we best approach the problem of teaching physics, given the computer technology and other resources that exist" (Nickerson, 1988a, p. 315). This conclusion is as valid today as it was ten years ago, I believe, and not a great deal of progress has been made toward this end over that period.

Research and development in educational technology

Exciting research has been, and is being, done in educational technology. Software and systems with considerable promise exist and more is being developed. I am not familiar with all that is being done in this area, but my limited exposure to it has been enough to convince me that what already exists represents a greatly underutilized educational resource. Microworlds have been developed to teach certain aspects of Newtonian mechanics (diSessa, 1982; White, 1984), electricity (Bork, 1985; Brown, Burton, & deKleer, 1981), electronics (Lesgold, Lajoie, Bunzo, & Egan, 1992), geometry (Anderson, Boyle & Yost, 1985; Schwartz, Yerushalmy, & Wilson, 1993), economics (Shute, Glaser, & Rahgavan, 1989), mathematical inquiry and exploration (Dugdale, 1992; Horwitz & Eisenberg, 1992; Horwitz & Feurzeig, 1994), among a variety of other subjects. The use of network technology in the classroom has also been explored in a number of studies (Bruce, & Rubin., 1993; Ruopp, Gal, Drayton, & Pfister, 1993; Tinker & Kapisovsky, 1992). But despite the promise of experimental studies, neither packaged software nor network technology has yet to have much of an impact on the everyday classroom.

Most of the work on the application of technology to military training has been done or sponsored by military research organizations and other DOD agencies (ARI, AFOSR, ONR, DARPA). I am not up to date on what has been happening in this world, but I would not be surprised to learn that technology has had a greater impact on military training than it has had on general education. Simnet constitutes a training system based on network technology that has no counterpart of which I am aware in either a military or a civilian context. My impression is that that represents a successful transfer of an experimental training system to operational use. There are numerous experimental training systems under development with DOD sponsorship (to wit, those described in Psotka, Massey and Mutter, 1988), and I suspect that some have got to the stage of use in operational training programs, but this is only a surmise.

Not only has research on educational technology been making progress, but research has also provided a deeper understanding of learning processes that should be able to inform future efforts to apply technology to education and training goals. Much has been learned, for example, about the constructive nature of memory, about the importance of conceptual understanding (in contrast to "cook-book" procedural knowhow), about the role of preconceptions in learning, about the need to make connections between in-school and out-of-school learning, about the usefulness of metacognition and self-management in learning , and about the importance of commitment to learning as a lifelong process.

Looking ahead

As we try to look to the future, the short-term trends in information technology are reasonably clear, as they were ten years ago. Most of those that have characterized the past ten years will probably continue. Even if there are no major technological breakthroughs leading to discontinuous leaps in progress, we can safely assume that the amount of computing power available to the average user will be much greater in ten years than it is today, just as today it is much greater than it was ten years ago. And ten years after that it will be much greater still.

The main uncertainties, in my view, have to do with software, with theoretical understanding of the processes of teaching and learning, and with the conventions and politics of institutionalized education. The big question is, will we in ten (or twenty, or thirty) years from now know much better than we do now how to use technology for the benefit of education and training ? And will we know better how to deal with the various nontechnical impediments to educational change? Even at its current stage of development information technology constitutes an embarrassment of riches. The challenge for those interested in education and training is not so

much to increase the power, versatility and educational potential of this technology, but that of discovering how best apply the capabilities that already exist to educational goals.

The questions raised in the first chapter of the 2020 book, having to do with how to apply technology to education and training, can still be asked today. Some progress has been made in answering some of them, but not a lot. This is not a criticism of the research that has been done. The questions are difficult ones, and not likely to be answerable quickly. But that is where the research is needed, because without some attention to these questions, the most amazing advances in technology are not likely to yield much of a impact on education and training that will show up in measures of results.

The possibility of an indirect impact on education

It may be that technology will have its greatest impact on education indirectly, outside the educational establishment. According to the Statistical Abstract of the United States 1992, between 1981 and 1988, the number of personal computers in use in K-through-12 classrooms went from 100,000 to 1.76 million. During the same period the number in use in homes went from 750,000 to 22.38 million (Table 1274). According to the World Almanac 1997, the percentage of U.S. households that contained a computer went from 7 in 1983 to 40 in 1996; it doubled between 1988 and 1996. (The number for 1996 was an estimate; p. 212.).

What data there are on the subject suggest that as of the mid 1980s the computers that were in schools were used primarily in computer science courses and that few teachers of other subjects (with the possible exception of mathematics) made use of computers in their classes (Pelgrum & Plomp, 1991). Of course the existence of a computer in a household does not mean that it is necessarily being used effectively for educational purposes either, but a computer in the home does represent ready access to resources that can have great educational value to those who avail themselves of them.

It has always been the case that some students come to school better equipped to learn than others because of support they receive from home or other outside-of-school resources. Some children have had many experiences with books, and are ready to learn to read if they do not know how already when they arrive at school, because their parents have read to them from an early age, frequented the library with them, given them books of their own, and perhaps maintained a library in the home. Such children undoubtedly have an enormous advantage over peers who encounter books for the first time at school.

Students differ too with respect to the outside-of-school resources on which they can draw in doing the work that is expected of them as part of their schooling. Parents and other family members are such a resource in some cases and not in others. Some students have places to which they can go to do homework without distractions and interruptions; others do not. For some, reference material is always readily available as is help in using it effectively; for others this is not the case.

Computers constitute a pipeline to resources that exceed both quantitatively and qualitatively what has been available heretofore. Students who have them in their homes, and who learn how to use them effectively for educational purposes, will unquestionably have an educational advantage over those who do not. And this is bound to be the case, I want to argue, independently of whether teachers pay any attention to computers in the classroom or not. It may even be more true of cases in which teachers are oblivious to the existence of computers than in those in which they are effective users themselves.

Concluding comment

Technology has had a profound impact on many areas of human activity over the past few decades. It has transformed transportation, medicine, commerce, communication, manufacturing, entertainment, . . . One can make a long list. By contrast, it has had relatively little effect on institutionalized education. What my grandchildren do in the classroom and the experiences they have are not enormously different from what I remember from my childhood, which predates the arrival of computers on the scene.

My guess is that for as far into the future as we can see, however dimly, the main impediments to the effective application of technology to purposes of education and training will not be technological in nature. I suspect that the enabling technology will continue to progress at a much greater rate than will knowledge of how to apply it effectively to teaching and learning. One of the major challenges will be to integrate the pieces, many of which probably already exist, into a coherent approach to education and training that makes sense as a whole.

There are many visions of the role of technology in education and training in the future. Some of them are very positive. To wit: "Sometime during this decade or the next, we will shift substantially to computer-delivered tutorial courses to provide . . . basic information and theories and to allow students to learn at individual rates. When this technology becomes widely available, we will hold the means to transmit such learning around the globe and allow professors to develop much more specialized or advanced courses for smaller groups of students. Some businesses like

IBM, which every working day instruct more than twenty thousand employees in a classroom or other learning environment, are already using such advanced educational techniques with a record of great pedagogical success" (Goodman, 1993, p. 98).

Some futurists predict the demise of the school, as we know it, seeing it replaced by learning environments that are independent of fixed times and locations. "In the future, technologies will allow learning to take place virtually everywhere. School buildings as they now exist could even be eliminated, replaced with a ubiquitous array of stimulating, interactive, and flexible learning technologies embedded in all human habitats" (Pesaneli, 1993, p. 29).

Others expect there to be little change, primarily because of impediments to change that have little to do with technology (Cohen, 1988) Historically, institutionalized education has been notoriously resistant to change (Cuban, 1984; Saransen, 1971), and, whatever else one concludes about the role of technology in it in the future, it seems safe to assume that simply bringing computers into classrooms will not suffice to produce any very dramatic effects.

A vision that I especially like is one described by Congressman George Brown, Jr., in 1982. "I see the possibility that, through information technology, the whole community will become a learning environment. . . Schools, museums, libraries, and government units will be connected through computer and television networks and will have access to a wide variety of data bases. Inexpensive microcomputers in homes will be able to access, through rapid, reliable networks, an almost unlimited range of learning resources. . . Updating of skills and learning of new skills through satellite transmission and computer-assisted instruction will be a standard feature of industrial and professional training. . ." (p. 52). May it be so.

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Shared Virtual Environments for Mission Planning and Team Training

R. Bowen Loftin
University of Houston
NASA/Johnson Space Center

Abstract

Historically NASA has trained teams of astronauts by bringing them to the Johnson Space Center in Houston to undergo generic training, followed by mission-specific training. This latter training begins after a crew has been selected for a mission (perhaps two years before the launch of that mission).

While some Space Shuttle flights have included an astronaut from a foreign country, the International Space Station will be consistently crewed by teams comprised of astronauts from two or more of the partner nations. The cost of training these international teams continues to grow in both monetary and personal terms. Thus, NASA has been seeking alternative training approaches for the International Space Station program.

Since 1994 we have been developing, testing, and refining shared virtual environments for astronaut team training. In parallel with this effort, we have also been preparing applications for training teams of military personnel engaged in peacekeeping missions. This paper will describe the applications developed to date, the technological challenges that have been overcome in their development, and the research performed to guide the development of and to measure the efficacy of these shared environments as training tools. We will conclude by charting a technology and research roadmap for the use of this training technology by the Army After Next.

Introduction

Many Space Shuttle flights include an astronaut from a foreign country. These astronauts usually carry out most of their training at the Johnson Space Center in Houston or in special facilities at other NASA centers. These astronauts often relocate their entire family to Houston. Thus, the support of international crews for the Space Shuttle has been at great cost to the nation from which the astronaut comes and has had a high personal cost for both the astronaut and his or her family. The International Space Station (ISS) program is a partnership between NASA, the European Space Agency, the Japanese equivalent (NASDA), and the Canadian Space Agency, and the Russian Space Agency. The four-person crews that will staff the ISS will be derived from the partner nations and will also include guest astronauts from other countries. For years those responsible for training astronauts for the ISS have grappled with the issue of training these international crews. In order to reduce the

costs of such training and to address the "political" issues of where training should occur, the NASA training community has sought means of training teams of astronauts, to some extent, while each astronaut remain in his or her home country.

Since 1994, we have been exploring the application of shared virtual environments for the training of international teams of astronauts. This task has encompassed a number of issues. Among these are necessary communications bandwidth, communications latencies, data transfer protocols, interaction metaphors, human figure representations, necessary fidelity (visual, audio, haptic), navigation methods, training transfer, and the psychology of team building.

Hubble Space Telescope Mission

In December, 1993 the Space Shuttle captured the Hubble Space Telescope (HST), and astronauts carried out a complex set of procedures to correct its mirror's optical problems, replace and upgrade certain instruments, and carry out planned maintenance (see Figure 1). This mission, by most measures, was the most challenging mission ever performed in the history of the United States' manned space program. Preparation for the mission was the most careful and detailed and brought unique resources to bear for the training of both astronauts and the ground-based flight team. In order to achieve the maximum state of readiness, virtual environments were used, for the first time, in the training of the flight team [Loftin, 1995].

This use of virtual environments for training joins a small set of applications that demonstrate the efficacy of this technology for training.

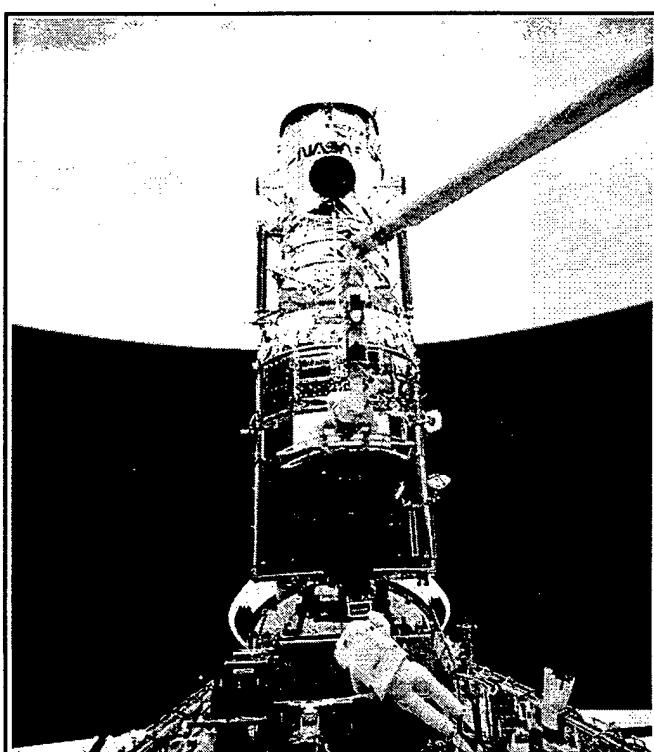


Figure 1: A team of astronauts prepares to maintain the Hubble Space Telescope during the December, 1993 mission.

Shortly after the conclusion of this mission, interest in using shared virtual environments to train international teams of astronauts emerged as a high priority within NASA's training community. NASA, the University of Houston, and the Fraunhofer Institute for Computer Graphics joined together to pursue an initial effort to determine the feasibility of a shared virtual environment for team training. The context for the feasibility study took the form of a simple extravehicular (EVA) simulation that engaged two astronauts, one located at JSC and the other in Darmstadt, Germany to

reenact a portion of the 1993 HST mission. In this simulation, the two astronauts changed out the Solar Array Drive Electronics (SADE) in the HST.

Months of preparation culminated in a demonstration on September 20, 1995, as Astronaut Bernard Harris (physically located in Houston at the Johnson Space Center) entered a virtual environment with Astronaut Ulf Merbold (physically located at the Fraunhofer Institute for Computer Graphics in Darmstadt, Germany). Their shared environment consisted of models of the Space Shuttle payload bay and the Hubble Space Telescope. The two astronauts spent over thirty minutes performing the major activities associated with the changeout of SADE. Their work included the real-time hand-off of the replacement SADE in exchange for the original SADE. At the conclusion of the task the two astronauts shook hands and waved good-bye [Loftin, 1997]. Interviews with the astronauts after this experiment revealed their support of and interest in this mode of training. They confirmed its utility for mission planning and the familiarization phase of training and acknowledged its value in reducing travel and personal segregation from their families and home environments. The results of this singular experiment have led to sustained funding from NASA to continue developing the technologies needed for this type of training and to design and conduct experiments to identify human-human and human-machine issues that require solution if this approach to training is to become part of the baseline training for the International Space Station.

International Space Station

Based on the success of the Houston-Germany experiment described in the previous section, we have been developing a testbed around the International Space Station. The training focus of this testbed is the conduct of scientific experiments and the execution of repair and maintenance operations within the ISS. Models of the interiors of selected ISS modules have been created (see Figure 2) and populated with both highly detailed, interactive models (polygonal) of the elements for which training has been developed along with detailed but non-interactive models (texture mapped) of the remaining interior elements. The racks of equipment for which training is delivered in this virtual environment comprise the Biotechnology Facility (BTF). Prototypes of these racks are currently on-board the Russian Mir Space Station, affording opportunities to investigate training transfer for currently-performed tasks (see Figure 3). A major distinction between this experimental testbed and the environment used in the Houston-Germany experiment described earlier is the transfer of the training context from extravehicular activities (EVA) to intravehicular activities (IVA). Whereas in the EVA environment, astronauts were represented as "suited" individuals, employing rather simple graphics to represent their bodies, in the IVA environment, high fidelity human models were developed to serve as avatars for the actual participants in virtual environment training. This approach sets a much higher standard for the fidelity with which the humans are represented and challenges the developers to find a reasonable compromise between

fidelity and graphics display performance (see Figure 4). Training participants are instrumented with sensors that enable real-time tracking of critical portions of their bodies (typically the head, torso, and wrists). Using fast inverse kinematics [Tolani, 1996], we have implemented avatar motion for the arms that reasonably represents the actual motion of the human arm during the operations carried out by the

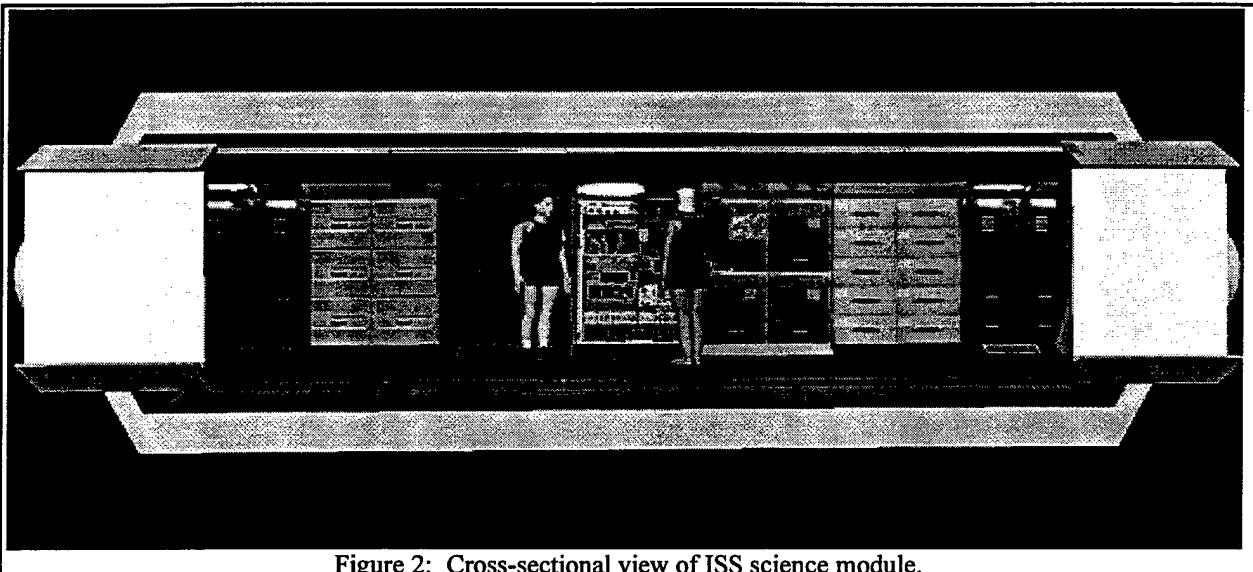


Figure 2: Cross-sectional view of ISS science module.

tracked real arm. Work is underway to further refine these inverse kinematics and achieve even faster performance and more natural positioning of the entire arm [Yang, 1997]. This work seeks to combine the best features of the analytic approach described by Tolani and Badler [Tolani, 1996] with experimental results from neurophysiological studies [Lacquaniti, 1982; Soechting, 1989a; Soechting, 1989b]. Leg motion is not implemented in the current environment since it does not play a major role (at least not in the sense of walking on the Earth's surface) for location in microgravity. Eventually, we will have to tackle this problem since leg position is important in some tasks where the human must exert substantial forces or torques on objects.

The current testbed (see Figure 5) has been implemented at three sites to support

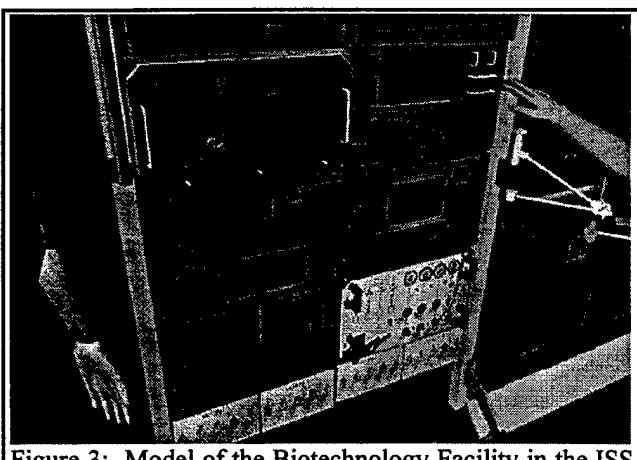


Figure 3: Model of the Biotechnology Facility in the ISS and on the Russian Mir Space Station.

experiments in training two astronauts while other personnel (trainers or managers) are able to view the actions of the trainees via a "stealth" mode. That is, the stealth view is a stereo camera view that can be positioned anywhere in the virtual environment but has no manifestation in that environment that can be perceived by the trainees. Final experimental procedures are now being developed in preparation for controlled experiments using this testbed. The goal of these

experiments will be a training transfer study to the "real" hardware (either in the Russian Mir Space Station or on the ground once the equipment is returned to Houston).

It should be noted that a major current thrust is directed at enabling the use of virtual environments in space to support "just-in-time" training. Such training, in low Earth orbit, might include environments shared by astronauts in the ISS and ground-based engineers and other professionals. Such an approach has been suggested for both emergency repair of complex systems and the conduct of medical procedures in response to serious injuries or illnesses that might be encountered during long-duration space missions.

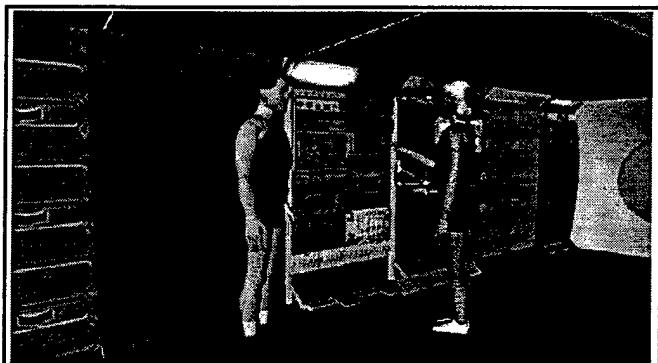


Figure 4: Avatars are used to represent astronauts in the ISS virtual environment.

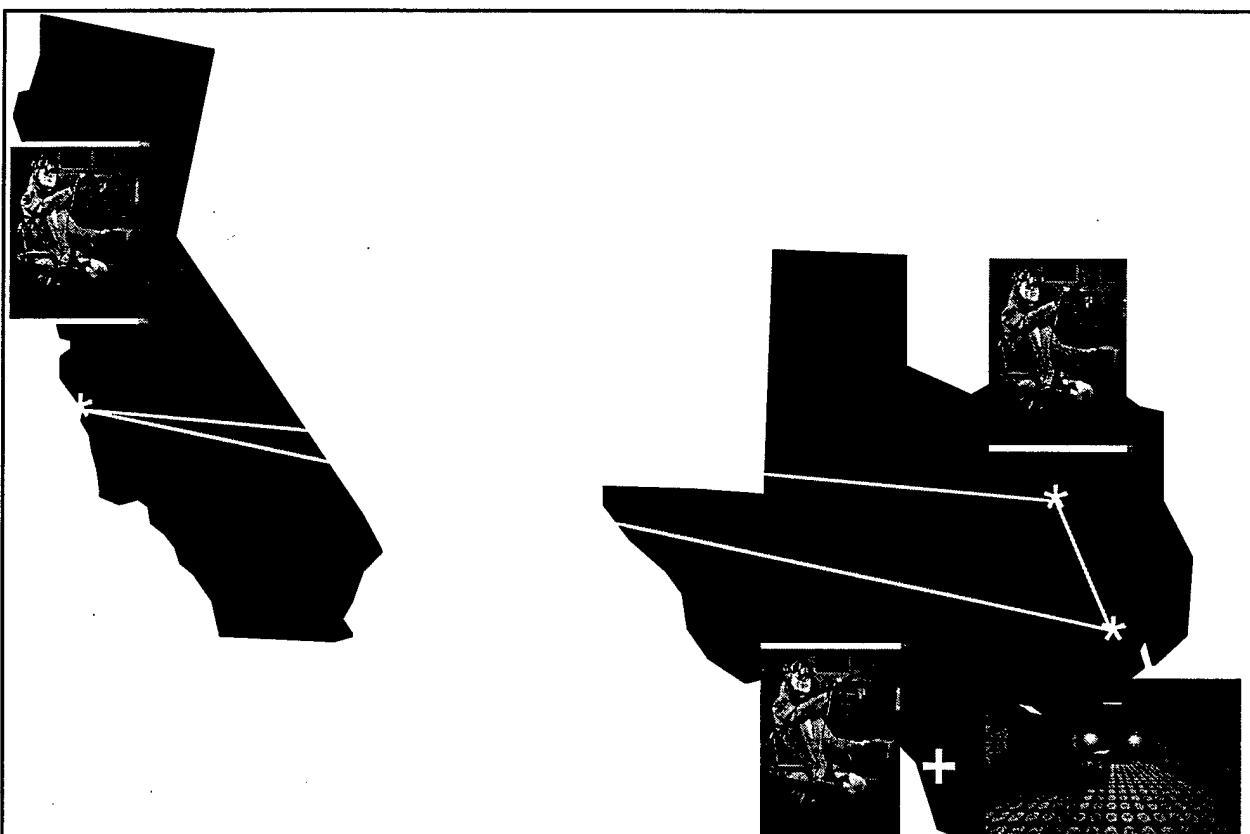


Figure 5: The distributed testbed showing the three sites where the ISS virtual environment has been implemented.

Peacekeeping Operations

With support from the Office of Naval Research, a group (comprised of the University of Houston, the University of Pennsylvania, George Mason University, LinCom Corporation, and Lockheed-Martin) have been conducting basic research and applying its results to develop a prototype application to address training of military personnel in Peacekeeping Operations. Work has been carried out in two areas of basic research: team training in virtual environments and the utility of virtual environments to support nonverbal human-human communication.

The context for the virtual environment application that is under development a checkpoint in a Bosnian setting (see Figure 6). This scenario offers a versatile testbed for investigating the use of shared virtual environments for training small units (fire teams and squads) for carrying out peacekeeping operations in a potentially hostile location where the focus is on employing the Rules of Engagement in the face of potentially unfriendly civilians and an enemy operating in a covert manner.

This application is being used to investigate the degree of training transfer to similar, real-world settings. In particular, we seek to challenge the trainees with distractors and to enable them to experience the consequences of failure to employ correct procedures and follow the Rules of Engagement. A typical training scenario might employ a distracter (an individual running across the soldier's field of view) aimed at drawing the attention of the covering soldier away from his team mate while that partner is engaged in checking the identification of the driver of a car stopped at a checkpoint. If the trainee's attention is drawn from "covering" his team mate, the consequence could be the driver taking a weapon from concealment and shooting the soldier who is attempting to check his identification. Thus, the results of distraction from one's assigned mission, can be forcefully brought home to the trainee. Figure 7 shows a typical scene generated by this application.



Figure 6: A U.S. soldier manning a Bosnian checkpoint.

In tandem with this application development we have been conducting a series of experiments in both team training transfer [Bliss, 1997] and nonverbal communication. The first experiments have focused on team navigation skills. A larger study is now underway, in collaboration with the Army Research Institute (Orlando Field Unit), to determine how well navigation skills acquired as a team in

a virtual environment transfer to the setting represented by the virtual environment.

The second set of studies has not yet been subjected to peer review, but results of two separate experiments have been analyzed. These results demonstrate that both stereotyped and some subtle human facial expressions can be reliably recognized by subjects in typical virtual environments. The reliability of recognition is comparable to that achieved by the subjects viewing photographs depicting the same expressions. Experiments are now being designed to investigate the degree to which the application that we have developed can provide training which is transferable to real-world analogues.

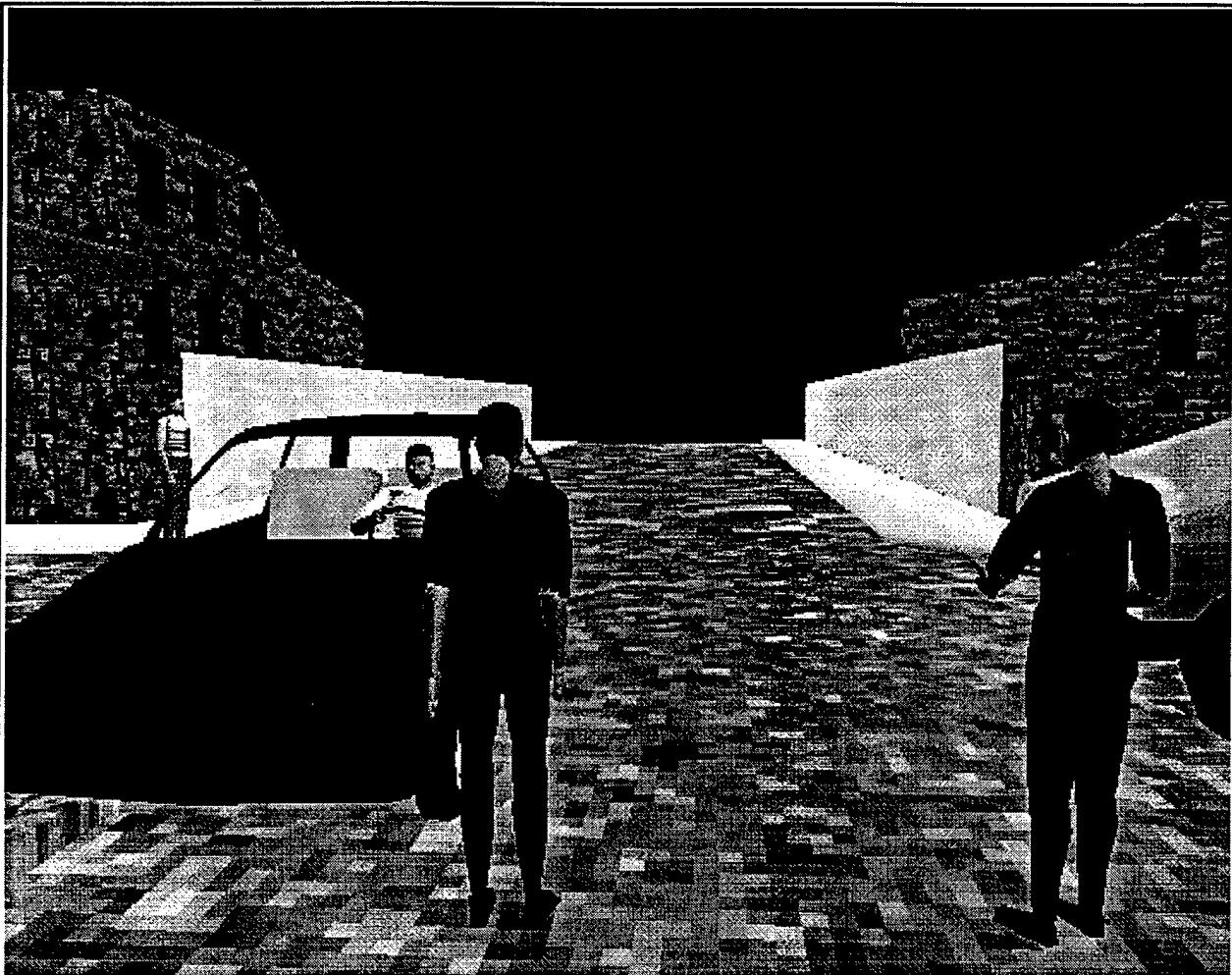


Figure 7. Two trainee avatars at a checkpoint in the Peacekeeping application.

Implications for the Army After Next

Soldier training and education have been identified as essential elements to the success of the Army After Next [AAN, 1997]. We view the results of the experiments conducted for NASA team training as well as our current work on training for peacekeeping operations as offering significant potential in preparing

the soldier (both individually and, especially, in teams) for the challenges of the twenty-first century. In particular, we have demonstrated that one can build synthetic environments that can be shared over distance by a group of soldiers and that have the potential to be deployed in the field or even used in transit to the site of operations for both mission planning and mission training. Such an approach is ideally suited to training small, cohesive units that must operate with considerable autonomy. Units of this type can not only plan for a given mission and collectively investigate and find solutions for a number of possible scenarios, but they can also gain sufficient experience in the synthetic environment to "... build trust, confidence, and a state of constant readiness . . ." [AAN, 1997] In this manner the probability of mission success is maximized while the time and cost of soldier preparation is minimized.

Acknowledgments

The author gratefully acknowledges the model development work carried out by Hector Garcia (ISS models) and Jan Lockett (human avatar models) as well as the compilation and analysis of training requirements and operational procedures conducted by Tim Saito. Lac Nguyen and Hector Garcia have been invaluable in implementing the virtual environment. Communications protocols used, in part, for this work were developed at Hughes Research Laboratories, principally by Peter Tinker and Kevin Martin. Support for this research has been provided by NASA/Johnson Space Center (through grants to the University of Houston and contracts with LinCom Corporation), the State of Texas, and the Office of Naval Research.

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Learning in Army XXI

LTG (Ret.) Frederick Brown

General Observations

A formidable challenge has been laid out recently for ForceXXI in the Annual Report of AAN for 1997: "*AAN simply seeks to provide the Army of 2029 with the physical speed and agility to complement the mental agility inherited from ForceXXI*" Fulfillment of that charge to improve mental agility in ForceXXI is hardly a "given" today. The record of assimilation of a centerpiece of ForceXXI, digitization, has been spotty. Provision of timely usable information which would foster improved mental agility by highly competent commanders and staffs remains more exception than practice. Enhanced learning which would foster improved human performance to cause such a change in execution of battle command has been infrequent.

I am not pessimistic at all. Bright, innovative leaders are learning by doing in open command climates. Most of the pages remain in rough draft if not blank. However, experience builds. Mistakes are less frequently repeated and insights are moving from speculation to near acceptance.

My purpose is to offer several perspectives about the general training path to ForceXXI and AAN from personal observations of various Army Warfighting Experiments (AWEs). Hopefully these may provide useful insights as to futures AAN issues - as much what not to do as what to probe more deeply while improving development processes.

The Joint Venture journey through ForceXXI to AAN is as much about evolving development processes themselves as it is about any particular product, hardware, software, training or otherwise. So, the Army XXI - Force XXI journey is still unfolding. Surprises are inevitable but it is increasingly certain that due to execution of AWEs in the crucibles of Combat Training Centers, the Army has at least 70%+ resolution on what it doesn't know yet needs for ForceXXI while gaining valuable insights for AAN.

The good news is that the Army now generally knows the array of processes available or needed to pursue Force XXI development to fruition and then to move on to AAN. One important insight has been recognition of the essential merit of the paradigm of DOTLMS itself as an effective reminder of important interrelationships which govern development. However, resolution varies by element of Doctrine, Organization, Training, Leader, Material, and Soldier (DOTLMS); some aspects (Material) have matured more than others (Leaders). The DOTLMS whole can and should be much greater than the sum of the parts. It is not today.

AWE Insights

There have been other useful insights gained in the observation of AWEs. Several are the overarching dominance of leader performance; need for balance in DOTLMS development; identification of steps for effective learning; requirement for new learning "TTP" (Tactics, Techniques and Procedures); and the need to structure learning to intensify learning processes.

Dominance of Leader Performance

The precepts of ForceXXI mandate increased attention to the preparation of leaders both in practice of Battle Command and competence in the execution of Tasks, Conditions and

¹ AAN Annual Report July 1997 p1.

Standards (TCS) of control. All of the AWE trials have reconfirmed the absolute dominance of the leader in decision-making processes - an effect multiplied as timely tailored information support is provided to a competent leader.

One superb example in Division AWE train up was personal use of multiple realtime combat information sources (Raptor, JSTARS and UAV combined occasionally with AFATADS) by Commander 1st Bde 4ID in order to find then strike enemy formations twenty to forty kilometers in front of his attack.² A priority mission of subordinate maneuver commanders was to protect the fire support (Artillery Bn) which itself moved frequently to range as well as to avoid counterfire. Observing the commander integrate combat power in time and space to achieve decisive effect was like observing a master at play in high speed, three dimensional Tic Tac Toe. The Commander was in his Tactical Operations Center (TOC) not with his command group forward on the terrain but portability of these digits is only an issue of time.

ForceXXI tactical decision making is clearly commander NOT staff-centered and is execution not planning-based. Preparation of commanders (Leaders) is vital. In each of the AWE exercises I have observed at company, battalion, brigade and now division in a Combat Training Center (CTC) crucible, unit performance has related directly to commander competence either in creating then exploiting friendly tactical opportunities or in responding quickly, effectively to enemy initiatives. Yet, I estimate that less than 5% of AWE resources to date (money and manpower) has been directed at this issue of improved leader performance.³ Regrettable but absolutely understandable. There is no tough, demanding regime institutionalized in the DoD bureaucracy similar to the acquisition and Operational Test and Evaluation (OTE) communities to demand results (and support provision of additional resources) in this "soft" area. The focus and money is in Material.

There is another important aspect to creating dominant leader competence. That is the utility of repetition of execution of complex operations in creating high performance organizations. Repetition of experiential learning creates highly cohesive, command teams which demonstrate hyper proficiency with reduced stress. I recently observed an Opposition Force (OPFOR) Brigade attack at the Joint Readiness Training Center against a trained, very well equipped organization. The OPFOR had modest capability, was on infrequently used terrain, attacking at night. Yet there was absolute command confidence. Tactical direction was executed by "audibles". The main attack axis was determined on the move responsive to the flow of the fight, only 45 minutes before attack time. An extraordinary performance. The commander had served for two years in one position as a Major in the Ranger Regiment, then in Delta Force and already had one year in command at the JRTC (ten rotations of operations). The subordinate commander is commanding his third company. Clearly general experience and repetition in execution of complex tactical operations have created an exceptionally competent, cohesive command team.

The unfortunate news is that Material has yet to be stabilized early enough in the train up to permit the effects of such repetitive experiential learning by commanders to occur. Much better train up in DAWE, but still occasional. Given the importance of competent leaders, this raises a challenging policy issue. Is it useful to accelerate development of Organization and Material when the profound effects of Leader, Training and Soldier have yet to be determined?

Need for balance in DOTLMS development

² Simulation Exercise 2 [SIMEX2]. September, 1997.

³ Although undocumented leader time has been diverted extensively from normal operating force responsibilities due to developmental challenges of M .

As iterative development (spiral) occurs for AWE each element of *DOTLMS* tends to evolve independently of the other elements. At present Material is strong, Doctrine and Organization following, with Leader and Soldier well behind, Training is probably skewed as a result. If all genuinely believe “we don’t know what we don’t know”, I assert that the most powerful paradigm influencing the path to AAN should be balanced *DOTLMS* development. Balance reduces the odds of skewed insights.

DOTLMS is not balanced today. The most serious deficiencies are in the human development areas - Leader, Training and Soldier. Developments in these areas have simply not been pursued with the same rigor and crisp purpose of Doctrine, Organization and especially Material, all of which are understood and well institutionalized in the TDA (Support) army and embedded in US defense industry. Correction of this imbalance in understanding of human development is the single most important action the Army needs to take in assuring a successful path to AAN.⁴

It is challenging to maintain necessary balance across major Army domains when development is sequential. It becomes really tough when there is an iterative spiral of trials. And the amplitude and period of development spirals need to be roughly in sync or outcomes can be distorted, as reflected in the JRTC example above where Leader, Training and Soldier clearly provided an important edge against Organization and Material.

Employment of a relatively new capability UAVs (Unattended Air Vehicles) provides a useful example of typical tactical interrelationships which need to be considered across *DOTLMS*. Note the following interdependencies involved in just one area, exploiting Unattended Air Vehicles (UAV) capabilities:

DocTTP: Control of UAVs between Intelligence (IEW) and Fire Support

Organization: TAC1 Command Post composition to advantage UAV data.

Training: Training Support Package (TSP) for UAV support of targeting cell

Leader: Flow of raw combat information (UAV). How far disseminated how fast for what Battle Command purpose? What are the overarching concepts and principles of this new source of intel data?

Material: Portability of UAV data (or JSTARS, or RAPTOR or ...) across information systems to Maneuver Control System (MCS).

Soldier: Preparation of CMF 98 or 13 soldier to know when routine cross sensor integration is appropriate

In sum, it is very tough to orchestrate change across *DOTLMS*. It was recognized early that soldier training in use of hardware and software would be a major task in preparation for the AWE. Accordingly, an excellent Central Training Support Facility (CTSF) was established for the TaskForce Army Warfighting Experiment AWE (TFAWE). But CTSF execution was a creature of Program Managers’ (PMs) vertical responsibilities by information system not a product of the cross-function information requirements of a horizontally-integrated, warfighting, brigade staff. Central focus on integrated Material was generally achieved after great effort to breakdown vertical stovepipes of the functional ATCCS “system”. Such institutionalized capability to cause balanced *DOTLMS* development is not currently paralleled in other areas, particularly Leader and Soldier. It should be.

Balance across *DOTLMS* is also important because tasks, conditions and standards

⁴ The deficiency is exacerbated by similar lacuna in organization for human development across the Department of Defense. The Defense Advanced Research Projects Agency (DARPA), the Defense Science Board (DSB), the Army Science Board (ASB) etc are simply uninterested in “soft” technologies yet the national strengths of two of DARPA’s greatest achievements, Internet and Distributed Interactive Simulation, rest in “soft” applications.

(TCS) of complex collateral tasks increasingly become specifications for material development (Information Systems) which in turn modify all other elements of DOTLMS.⁵ Tough chicken and egg proposition.

Identification of steps for effective learning

A challenge in preparation for AWEs has been how best to train command and staff in the tasks, conditions and standards (TCS) of control. Experience since the initial “AWE”, NTC Rotation 94-07, has confirmed the necessity of three levels of learning for all leaders, particularly those at company command and above. They are:

1. *Know the basics (blocking and tackling principles)*
2. *Know specific hardware/software of ABCS /FBCB2*
3. *Practice execution by combining 1 and 2 to fight better, differently.*⁶

A common tendency has been to assume that step one has occurred -that the training “steady state” of the AWE unit, despite turnover, is basic BCST competence. Therefore AWE preparation focuses on step two, without having firmly established a baseline tactical context within which subsequent learning can occur. Then as the Material Developer (M) comes up with important product improvements (both hardware and software) eagerly sought by the unit, the unit runs out of training time before step three can occur with sufficient repetitions to permit the unit (staff) to fight better differently. This happened in the TFAWE (97-07) where for good, understandable yet regrettable reasons, only one repetition of step three occurred prior to execution of the AWE. There has been notable improvement for Division Army Warfighting Experiment (DAWE) with scheduled monthly Staff Drills or Simulation Exercises (SIMEXs) supported by CTC-BCTP. The SIMEX2 ramp up exercise conducted in September was in effect DAWE 1. The benefits of repetitive learning in step three prevailed in the DAWE 2 - the scheduled DAWE.

There is a fourth step in developmental trials. That step is to document DOTLMS changes as they occur in iterative trials. When individuals and teams are permitted to iterate warfights, they discover new, better ways of fighting as they become more competent. The end state of the previous trial becomes the start point for the next iteration. There is a major practical challenge in providing documentation in sufficient detail to create an ad hoc Training Support Package (TSP) which will train for the next iteration. The value of recall of shared tactical experiences (good and bad) captured in rough TSPs (SIMEX VuGraphs) was evident in preparation for the DAWE in building cohesion (teams). Brown bag “lunches” discussions were used very effectively to create cross function commander “teaming”. Learning was the primary focus. Increased leader team cohesion was the observable outcome.

Then a larger systemic issue arises which faces all leaders today. That is capturing sufficient time for leaders in the peacetime Army to learn the new steps to the point that there is “digital default”. That is that under stress, confidence of the user in the performance of digital systems is sufficient to work thru problems, rather than immediately revert to analog past practices. Tough to spiral the development unless and until this fourth step is determined and resourced, particularly in leader time to train and thereby to develop the competence and

⁵ Collateral tasks are complex cross battle function tasks such as Joint Suppresion of Air Defense (JSEAD).

⁶ The near exclusive Material focus of development has caused only step 2 to be resourced predictably with funding and personnel. Personnel turbulence has made step 1 challenging.

confidence which is the best antidote to stress.⁷

Requirement for new learning “TTP” (Tactics, Techniques and Procedures)

Success in the processes of focusing combat power in time and space in accordance with the doctrinal precepts of ForceXXI is genuinely difficult. Not for neophytes. Command and staff must deal simultaneously with both horizontal and vertical tasks. Horizontal tasks are those involving lateral coordination across one echelon of command and staff actions in a unit such as a battalion. Vertical tasks are those requiring vertical coordination within a function such as Fire Support from the Forward Observer up to Division or Corps Artillery echelon.

Identification of staff team composition and tasks in a typical unit - Division for DAWE - is challenging. It is more difficult assuring that complex *ad hoc* teams are prepared to act in unison to enable complex collateral tasks such as deep attack. Excellent contractor work has produced a Digital Operating Guide (DOG) for the DAWE which documents information requirements for the successful execution of missions which have been prioritized by the Division Commander. The DOG identifies the following contributors to command and control of Cross Forward Line of Troops (FLOT) attack directed for the Division Commander by Division Tactical Command Post (CP) 1:

Staff teams: G3, G2, AVN, FS. Secondary: ADA, Engr.

Information Sources: 12 (UAV, JSTARS, Guardrail etc)

Information Products: 15 major (FRAGO, Friendly Unit Location etc)

Voice Comms Systems: 4 (SINCGARS, MSE etc)

Data Systems: Primary 4 (MSC/P, ASAS etc) Secondary 4 (FAAD etc).

For tactical decision-making within Div Tac 1, there are six teams drawing on twelve information sources using twelve communications means to produce fifteen explicit information products to execute an important complex very time sensitive tactical task.⁸ This is just one task in four major missions consisting of eight major tasks.

It gets more difficult. Creation of conditions to enable effective individual and team learning to execute complex operations such as Cross FLOT attack is difficult under the best of conditions. DivXXI is largely Army, active component only. Task Forces can be both joint and combined. Often Task Forces are *ad hoc* as capabilities are combined globally (netted through distributed information). All missions executed to increased tempo of battle.

It seems clear that new learning processes (TTP) will be necessary to create and sustain units prepared to master, routinely, such complexity. New forms of simulation enable immersion-based creation of demonstrations of execution of complex tasks. New distribution means permit distributed execution while maintaining quality control. New TSPs permit repetitive learning to increasingly challenging conditions or standards. Confirmation of “best practices” and their export to AWE participants is overdue if Training is to catch up.

Need to structure learning to intensify learning processes.

As the AWE evidence accumulates, it appears that development of command and staff mental agility appropriate for both FXXI and AAN will require solid learning opportunities across Total Force with appropriate opportunities for joint and combined learning. These

⁷ Ft Knox is working this issue with staff on site at Hood but they are just cracking the surface of a much deeper challenge.

⁸CAMBER. Division XXI Digital Operating Guide for Leaders Coord Draft 1, October 1997.

opportunities are necessary but insufficient unless time to learn complex tasks is provided to both commanders and staff officers. I believe that time is the most critical resource in leader professional development today.

The AWE record makes the point. With the impact of summer personnel turnover within the 4ID, monthly staff drills or SIMEX, structured staff exercises and Job Books to account for individual and team proficiency became necessary. In effect, learning had to be structured to achieve explicit results. And as a very useful byproduct, significant staff cohesion developed as new horizontal and vertical teams were discovered in the crucible of warfighting.

That is the lesson. Commanders and staffs at tactical echelons need to be treated as teams and exposed to structured learning exercises, repetitively, crawl, walk, run just as Armored Fighting Vehicle (AFV) crews are trained. Training support will certainly differ as the goal is learning not just training, but that will happen. Less certain is the prospect that a peacetime Army will free leader time in the amounts required to generate genuine proficiency under stress unless there are formal evaluations of individual and team proficiency.

It is absolutely essential that the fruits of training developments be combined to intensify, significantly, command and staff learning processes. Then, when that is established, explicit accountability of leader learning appears essential.

Looking forward - likely new learning directions/needs

The AAN Annual Report expresses explicit human requirements:
*“...mature, highly experienced leaders....1) mastery of increased skill sets; 2) greater experience in both command positions and staffs; 3) a firm foundation from which to exercise battlefield intuition; and 4) the ability to successfully withstand higher levels of stress due to psychological maturity and experience”.*⁹

Well stated, although I would assert that four above comes from success in one thru three. There are some significant challenges in making this desirable end state happen. The road ahead will be less rocky than the past path because the AWE journey itself is becoming institutionalized. More good people understand what is to be done. But still some tough new work is essential. Expanded learning research seems clearly required. New management teaming seems necessary to ensure new directions of research and development are pursued. And a new culture of leader “testing” may be required to ensure that higher levels of individual leader tactical competency are sustained.

Learning research required:

+ Determine the learning requirements for competent performance of Abrams M1A2 as a command and control vehicle (C2V) for mounted force commanders (platoon through battalion) as well as an Armored Fighting Vehicle (AFV). To date there has been no substantive research in this area yet M1A2, now fielded for several years in operational units, represents a practical C2 testbed, unused. As fielded systems, the M1A2-equipped battalions could also be useful foci for assessment of the impact of intensified learning on building cohesion and stress

⁹ AAN op cit. p22

reduction.¹⁰

+ Use of Collaborative Virtual Environments (CVE) for tactical decision-making. How should CVEs be designed to best support tactical decision-making? Need learning exercises for individual leader and staff team CVS applications? Are there three steps to learning here too? What are the appropriate cues for useful staff team learning to occur in CVEs? To compare to auto driving instruction, which cues are the bugs on the windshields? Which are the genuine red lights? What is the difference (between important and unimportant) in a CVE? I am unaware of any support being provided how to most effectively draw on the capabilities of virtual environments to accomplish tactical missions better, faster in either TF or DAWEs. The ARI/ARL effort Cognitive Engineering for the Digital Battlefield Study is very important; but, it is a useful start, only aiming at basic research outcomes. Where has the human development community been in this area?

+ The TOC Concept Evaluation Program presently being conducted at the Ft Knox Mounted Warfare BattleLab is an important, precedential, look across DOTLMS to develop improved command and control for mounted maneuver, brigade and below. This effort should be monitored and supported as “a way” to draw on TES to “beat the developmental spiral” drawing on new methodology proposed by Dir PerTech. Beyond that, where is a comparable effort supporting brigade through corps?

+ Develop then prototype learning strategies for intensive staff team learning in units. The Force XXI Training Program products currently being used by brigades at Ft Hood provide a thoughtful first cut. How should that work be exploited?

+ “...soldiers, units and leaders must be deliberately conditioned to sustain operational tempo notwithstanding system interruptions.”¹¹ Assess desirability and feasibility of extending the learning strategy methodology of UCOFT as “teaching machine”. Is UCOFT methodology appropriate to provide degraded mode learning for small units or for BCST? A useful methodology for creating rapid team building? Will “run” proficiency gained by “teaching machines” compensate for fatigue, perhaps for lower mental capacity personnel? These are currently unknowns. There has been no work to date to apply UCOFT insights to CCTT yet they represent \$billion products. No agency is charged to do this; that is, assess effectiveness and efficiency of different collective task learning strategies.

+ Review existing learning policies and procedures to develop opportunities supporting intensified learning (including intensified team/cohesion building). The objective is to reduce time required to develop exceptional proficiency given challenges to availability of leader time to train in peacetime Army. What is the most effective learning strategy - crawl, walk, run (priority small unit and BCST tasks)? The late maturation of Material and paucity of time for Training and Leaders in AWEs precluded opportunities to experiment in this area for the AWEs. How much of each is needed and when to increase cohesion? Best locale for which tasks -

¹⁰ Genuinely remarkable Live Fire tactical performance has been achieved by two [not normal four] tanks in Table XII execution. This success should be extended to the M1A2 as a C2V. On a scale of one to ten, learning use of the Abrams as an AFV is eight or nine; as a C2V, two, perhaps three - degraded performance due to lack of human interface research and development?

¹¹ Ibid p23

homestation or CTC?. Learning curve on repetitions of leader and staff team learning?

+ How to build TSPs for continuing BCST during trials in order to train leaders to using modified TTP? The experience of DAWE appears useful - Division chain of command define then prioritize missions and tasks, then document information requirements in the Digital Operating Guides (DOG). All echelons collect TCS detailed warfighting vignettes so that appropriate structured training can be created? DAWE may have provided useful insights here. Should that be the future development path?

+ Confirm appropriate time required for average officers and non commissioned officers to learn "digitally". That is train basics, then hardware/software and finally "new ways to do new things". For battle command and staff skills and knowledge, address both horizontal teams (by echelon) and vertical teams (by function). This is a subject of a starting ARI-Knox effort at Ft Hood sponsored by Knox and actively sponsored by Hqs TRADOC. This is necessary but how to institutionalize a more extensive effort?

+ Develop low cost, stand alone, vertical and horizontal task and staff team learning support. A prototype was created for DivAWE. How to ensure that or an improved version is included in new constructive simulations (WARSIM)? Methodology to ensure WARSIM will support likely TCS of AAN? Any one charged to review that? Who will assess training adequacy? That is, conduct Training Effectiveness Analyses of evolving products as the relate to Leader or Soldier or Training?

New management teaming?

New teaming responsibilities may be appropriate to develop new training support products. The AAN Annual Report clearly acknowledges the utility of intensive learning exercises drawing on synthetic environments "*Synthetic training environments, in the form of virtual, constructive, and live simulators, may allow highly effective training under conditions both safe and, in some cases, nearly indistinguishable from actual combat. In the future, newly formed units or staffs may build trust, confidence, and a state of constant readiness by working through a series of increasingly demanding exercises in a synthetic environment...*".¹² Well written. The road from vision to accepted learning exercises will be challenging. At least there is a working first approximation of the necessary structured learning undergoing review at Ft Hood at present with the Force XXI Training Program. Contractor support has been charged to draw on the experience of the DAWE to create Digital Division TSPs with Corps TSPs about to follow. This is a necessary and useful effort - an important waystation on the path through FXXI to AAN. And that product as well as the considered assessments of those reviewing the AWE process can guide the training development which will follow. But that is only the start. It does not provide authorities and responsibilities ensuring that Proponents remain current as AWE development spirals continue hopefully for each element of DOTLMS simultaneously.

For governance of this substantial training effort:

Where is the team with responsibilities, authorities and resources to execute then overwatch necessary research which appears required before the full AAN vision can be realized?

Who matches continuing Training development with evolving requirements of other DOLMS?

¹² AAN op cit. p.23.

What are the management responsibilities of the Department of the Army and TRADOC with respect to development of learning (training and education) models - which cross jurisdictions currently?

Leader learning and evaluation

Learning/evaluation of leader competence in the TCS of control seems essential. DocTTP mandate complex processes which must be executed rapidly under stress (SOSR of hasty breach, Counterfire, JSEAD). Staff officers must know the procedures in detail or know when to employ supporting job aids. There are substantial Aviation [pilot] precedents to assessing officer tactical proficiency - in the science of demonstrated proficiency in performance of TCS. Objective assessment not expected in the art of battle command. How should these quality control tools be applied to leader learning of the TCS of control?

In sum, the water glass relating to Learning in ArmyXXI is at least half full. Probably higher because there is increasing awareness of the Leader, Training, and Soldier challenges. But hope and good intentions are not effective policies and programs.

Bottom Line:

Three broad issues stand out in addressing the journey through FXXI to AAN:

- Need to intensify learning opportunities significantly to achieve necessary mental agility in officer corps given distractions of peacetime Army.
- AWE/AAN development processes, particularly balanced DOTLMS, need to be shaped to develop battle command and staff competence equal or greater to that achieved Company and below in the post RVN rebuilding
- There is no “soft tech” DARPA or other DoD resource to backstop the meagre human and organizational foundations of either FXXI or AAN. To focus these thrusts FXXI-AAN should create a human development Research Alliance combining Leader, Soldier and Training of DOTLMS (“Project Bravo” successor to Gen Thurman’s Project Alpha addressing the need for quality personnel in the Volunteer Army?) . This Research Alliance should, *inter alia* , address the research issues raised above.

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fjbrown

fjbrown@snap.org

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The Application of Special Forces Selection and Assessment Techniques and Procedures to the Army After Next

Dr. Michael Sanders, Dr. Michael Rumsey and Dr. Judith Brooks
U.S. Army Research Institute

Summary

An early analysis of the soldier and mission requirements for the Army After Next (AAN) indicates a high degree of commonality between the current Special Forces (SF) and the soldier requirements for AAN. That is, both groups are or will be: highly trained on a variety of hi-tech equipment, geographically dispersed in small teams, and operating independently on a number of politically sensitive missions. This paper reviews relevant procedures and findings drawn from 20 years of Special Operations Forces (SOF) experience in soldier selection and assessment and suggests ways in which they could be considered for application to the AAN Light Infantry forces.

Background

As the Army prepares to meet the challenges of the 2010 timeframe, changes in doctrine, in tactics and in U.S. demographics will require us to tailor the manning process that the Army uses to fill the force. The manning process and the indicators the Army uses to identify who should fill each slot in the force (the job-soldier match) are critical to the future of the AAN. According to Army Training and Doctrine Command Pamphlet 525-5, Force XXI Operations, "Quality soldiers, trained and led by competent and caring leaders, will remain key to success on future battlefields. Soldiers in the twenty-first century will be faced with a wide variety of challenges in preparing for and executing missions in full-dimensional operations.... Increased flexibility and adaptability will be required at all levels, along with increased responsibility at much lower ranks."

For the past 20 years, the Army has orchestrated a quiet revolution in one of its manning processes: the assessment and selection of SOF personnel. SOF has tended to emphasize the selection of soldiers who can remain "mentally alive" while experiencing deep fatigue and personal discomfort. SOF soldiers must also be capable of performing their duties while on solo missions in sensitive environments. Ultimately, each SOF soldier must demonstrate the stability, dependability and adaptability required to operate independently in fluid and challenging situations.

The SOF community developed its initial assessment and selection program on a limited basis in 1976 based on elements from similar programs, including those of the World War II Office of Strategic Services, or OSS; the Central Intelligence Agency; and the British 22nd Special Air Service, or SAS (see Figure 1). In 1987, the JFK Special Warfare Center and School began developing a selection program to use in screening candidates for SF training. The first SF assessment and selection began in June 1988. Since then, the assessment and selection process for SOF units has continued to evolve

and expand. Today, these same techniques are also used to screen candidates for the Rangers and for the 160th Special Operations Aviation Regiment. SOF assessment and selection, which has been an evolutionary process, has produced revolutionary results. The lessons learned could have a similar revolutionary impact on the way the Army mans the AAN.

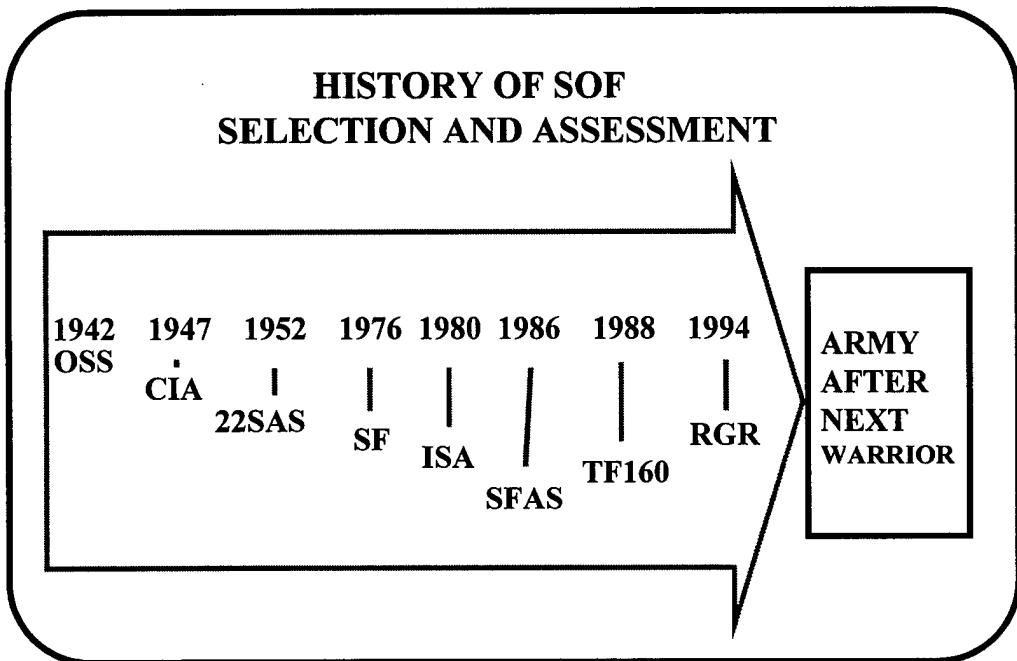


Figure 1.

Assessment and Selection Process

Overview. In general, the development of an assessment and selection process (shown in Figure 2) begins with a review of current and future mission requirements. The next step is to identify the attributes soldiers must have to perform their missions successfully. Assessors then develop or adapt screening tools that can determine whether the soldiers possess the critical attributes. Once the tools have been validated, they are used in the assessment programs. Included in the SOF screening tools are the General Technical Composite, or GT, of the Armed Services Vocational Aptitude Battery, or ASVAB; physical-fitness tests; and spatial-relations tests.

Analyses of SOF missions and jobs, including a recent one conducted by the Army Research Institute (Russell, et al., 1996), have consistently identified such attributes as adaptability, dependability, physical endurance, and cognitive skills such as trainability or decision making ability. ARI is currently examining which attributes are related to actual job performance. Preliminary analyses suggest that some of the best predictors are motivational attributes assessed by biodata instruments. Findings such as these are valuable for fine-tuning SF selection strategies and programs.

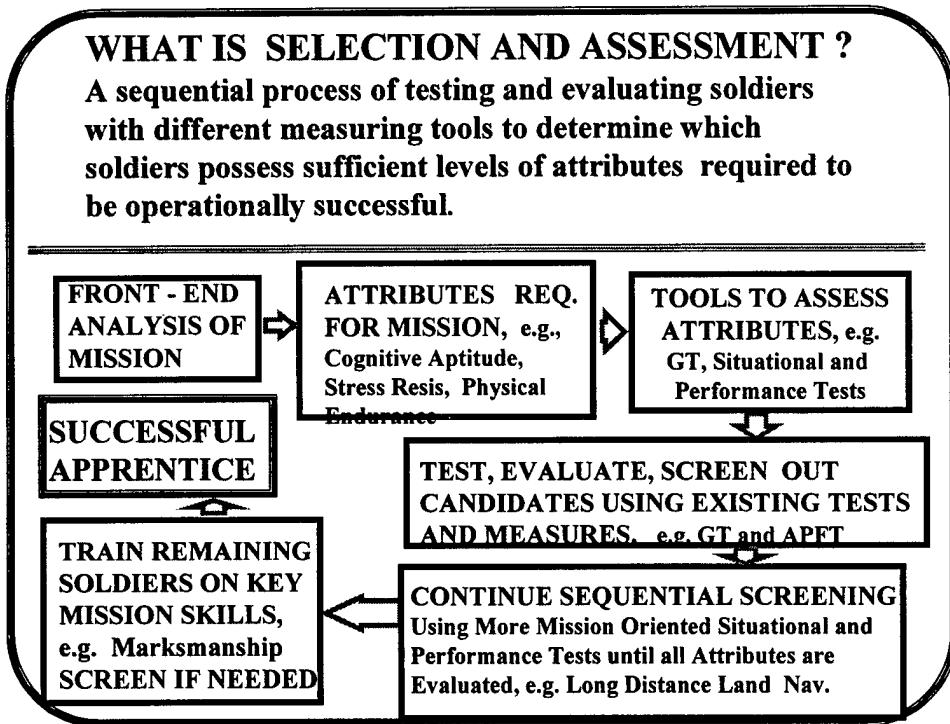


Figure 2.

Figure 3 shows the sequential SOF assessment and selection process. While the numbers vary slightly among the assessment and selection programs of the various SOF units, the statistics are representative of all those programs. The overall assessment-and-selection process typically begins with an initial screening based on a soldier's GT test score from the ASVAB and other considerations such as high school graduation. The second screening is based on the soldier's PT test score. Only 59 percent of those who take this test meet the requirements. Soldiers who pass the first two screenings, satisfy a background check and meet specific psychological requirements are eligible to attend a structured assessment-and-selection program, where they undergo additional psychological and performance screening.

There is a great deal of truth in the adage, "The best predictor of future performance is past performance." More specifically, the best predictor of one's future performance is his or her recent performance on similar tasks. The screening process enables the Army to select those soldiers who are likely to meet performance standards. Assessment continues into the training phase, where soldiers undergo situational testing.

Soldiers selected during the assessment and selection process have a high probability of success during operational training and assignment, as demonstrated by the low rate of 15% attrition in the Special Forces Qualification Course and the low incidence of involuntary discharge in operational units. The evidence supports the conclusion that the overall monetary savings resulting from the selection-and-assessment process have far outweighed the initial investment.

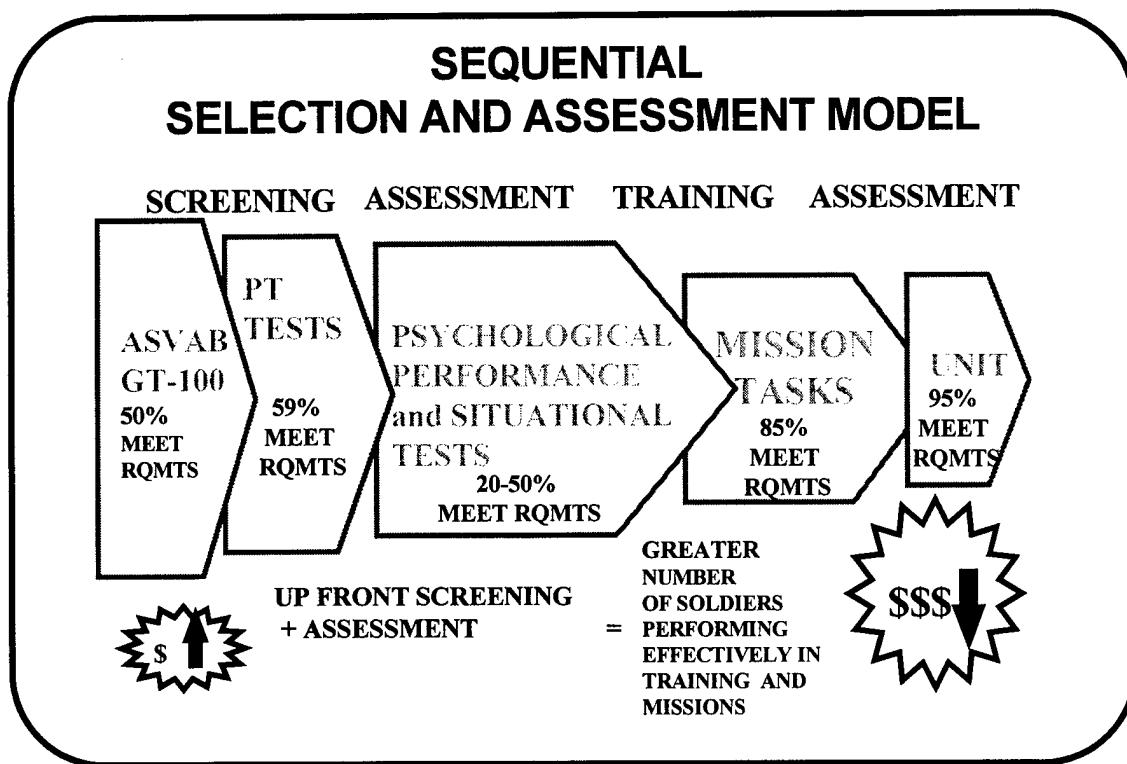


Figure 3.

Key features. A review of SOF's assessment and selection process leads to the identification of the following features as critical to its success:

- Use of a front-end analysis to determine mission and job requirements and the required soldier attributes as the first step in assessment and selection.
- Use of an assessment-and-selection process which focuses on the critical attributes needed to perform the job.
- Early screening of candidates
- Continuation of screening through job-related situational and performance tests.
- Establishment of objective performance standards for assessment, selection, and initial screening.

SOF Applications to AAN

General considerations. The assessment and selection methods developed for SOF offer great promise for addressing the needs of AAN. It should be noted that the SOF procedures are substantially different from procedures currently in use across the Army as a whole in terms of both breadth and depth. Breadth here refers to the extent of coverage across the soldier's life cycle. The current model for the Army enlisted force in general can best be characterized as a single hurdle model. Test-based assessment for selection is conducted at initial entry. Later personnel decisions are based on

accumulated performance information in the individual's records. Fortunately, we have found that this information is related to future job performance (Silva, Rumsey, Mael, & Busciglio, 1993), but the use of this information does not constitute assessment targeted to the personnel decisions to be made, such as promotion or assignment. The SOF model involves multiple hurdles. At several points in the soldiers' career, they would be tested and either screened out or determined to be qualified for the next assignment.

Depth refers to the extensiveness of assessment testing conducted at each stage in the life cycle. Assessment testing within the Army as a whole is less comprehensive than SOF testing. At initial entry, where enlisted testing is most thorough, it consists primarily of cognitive assessment, as well as limited physical and moral screening. The SOF model supplements such measurement with intensive situational and performance tests.

There are sound practical reasons for such differences. Increments in testing comprehensiveness are costly, both in developmental and implementation terms, as well as in terms of their impacts on the Army's personnel acquisition and management process. As a rule, such increments are more cost-effective to the extent the following conditions are met: 1) the number of individuals to be tested is within reasonable bounds, 2) there is a reasonable selection ratio, 3) the consequences associated with performance differences are substantial, and 4) the population to be tested is geographically concentrated rather than widely dispersed. All these conditions tend to be more favorable in the SOF environment than across the Army as a whole.

In AAN, conditions may be more favorable with respect to comprehensive testing. As the Army moves toward the model described earlier--groups highly trained on hi-tech equipment, operating independently in small teams on a number of politically sensitive missions--the consequences associated with performance differences will tend to increase. Also, to the extent testing is focused on those who will occupy the most critical positions in the AAN, the number of individuals tested is more likely to remain within reasonable bounds. Thus, it is reasonable to explore a SOF-based assessment and selection model for at least a segment of the AAN.

Vision of the assessment and selection system of the future. The current selection and classification system for initial entry soldiers, as noted earlier, is based primarily on a cognitive battery, the ASVAB. Research has identified two additional promising measures, a spatial test and a temperament measure, for possible future implementation (Rumsey, Peterson, Oppler, & Campbell, 1996; White & Young, 1997). However, one major gap remains. What is not known is whether the attributes that are being measured now are the ones that will be needed for success in the AAN. Some preliminary research into this question indicates that cognitive ability, the cornerstone of the current selection system, will remain important. However, it also indicates that a number of other attributes such as adaptability, which are not assessed now, will also be important (Rumsey, 1995; Rumsey, Busciglio, & Simsarian, 1997). More intensive analyses are needed to provide a basis for determining how entry testing can best be shaped to serve

the needs of AAN. These analyses will help determine whether the ASVAB of the future will be augmented by additional tests and measures not currently anticipated. An already-developed but not yet implemented automated assignment system, the Enlisted Personnel Allocation System, can be used to ensure that test scores are optimally used for classification into a Military Occupational Specialty (MOS) after the initial selection decision has been made (Rudnik & Greenston, 1996).

The potential for improved assessment for post-enlistment personnel management decisions is great. The greatest impact of such assessment might well be in terms of improved promotion decisions, but assessment improvements could also affect a variety of other decisions, such as eligibility for reenlistment, placement into key assignments, MOS reassignment, and selection for critical training opportunities. The technological advances in information-age computing make it potentially easier to develop a means of testing a soldier at each stage of his or her career. If cost-effective realistic simulations and exercises could be developed for this purpose, information on individual soldier performance in these and in operational assignments could be objectively recorded into databases and retrieved as needed. The SOF experience suggests that use of the Army's training centers and schools as screening and assessment sites may merit consideration. It also argues for consideration of a board which incorporates the judgment of leaders who are trained and experienced in the operational environment. However, the feasibility of these proposals in the AAN context is very much an issue; one that will need to be carefully assessed before they can be forcefully advocated.

Recommended future steps. AAN mission and job requirements can be projected based on promulgated doctrine, as well as from observations from AAN War Games and related simulations and exercises and interviews with key subject matter experts. From these analyses will come an analysis of the skills, knowledges and abilities that AAN soldiers must possess at each organizational level. Based on this analysis and a concurrent analysis of the projected Military Examination and Processing Station (MEPS) structure, the projected Military Occupational Specialty (MOS) assignment process, and the proposed structure for Basic Military Training and Advanced Individual Training for 2010, a sequential selection and assessment system can be developed. This system will incorporate the following components:

- a) initial guidelines for assessing personnel and selection of personnel for specific MOS groups and for classification into a specific MOS,
- b) the major evaluation and screening points,
- c) the types of attributes and abilities that will be assessed at each point,
- d) a conceptual model for a data base and data integration system, and
- e) guidelines for continual validation and updating as needed to insure the system does not lose currency.

Would such a system inevitably incorporate expanded testing at each point, including situational testing? The answer to that is no. The extent to which current testing would be expanded, if at all, should depend on the extent to which the mission and

job analyses identify a need for such testing and the extent to which new testing could be justified as feasible, among other considerations identified by key decision makers.

However, the SOF model offers a vision of what the new system could look like. It has been shown to work well in the SOF context, and should be seriously considered for addressing the personnel challenges of the AAN.

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Warfighter Biomedical Assessment in Sustaining Individual and Unit Effectiveness in Army After Next Operations

**Gregory Belenky, M.D.
COL, MC
Division of Neuropsychiatry
Walter Reed Army Institute of Research
U.S. Army Medical Research and Materiel Command**

Introduction

This paper is divided into three sections. The first section presents a notional view of Army After Next (AAN) operations to serve as a framework for discussing human performance. The second section discusses the factors affecting human performance, effectiveness, and resiliency in combat operations. The third section describes how evolving biomedical assessment technologies, including warfighter biomedical assessment monitoring, could assist in sustaining individual and unit performance, effectiveness, and resiliency in AAN operations.

Army After Next (AAN) Operations

AAN units will consist of small (3-5 person) teams, with each team controlling massive firepower and a large volume of battle space. The teams will be engaged in variable, often high, tempo operations. For a given operation, each team will engage in 2-3 pulses of combat each day, with a typical operation lasting 5-7 days. Each pulse of combat will be the 21st century equivalent of an air-land battle with all the attendant complexities of planning and execution. In the AAN concept, each team-member and each team is critical. If a team-member fails, the team fails. If the team fails, the

operation fails. More so than in the past, battles will be won or lost at the small unit level and both speed and accuracy will be critical to effectiveness and operational success.

The tempo of operations will be rapid; teams must act in parallel with other teams, often making decisions without consultation with other teams or with higher echelons of command and control. In this they will be aided by a shared, detailed, and accurate real-time picture of the battle space. However, even the most accurate, detailed, and frequently updated picture of the battle space does not necessarily reveal intentions either of the enemy or of one's friends. In fact, the enemy, assuming perfect intelligence, may deliberately act counter to obvious expectation. To achieve effective, concerted action without detailed coordination depends not only upon a shared, accurate picture of the battle space, but also upon a common mental model that projects from the present actual state of the battle space into the near future. In effect, each team must model the intentions of enemy and friends and use this model to project from the present picture of the battle space to its desired future state, and project what intervening actions will be needed to achieve it. This is clearly more than a problem in information density and complexity and not subject to solution simply by better sensor fusion.

Adding to the demands of actual operations will be the pre-deployment ramp-up. As envisioned, a typical ramp-up to an operation would last 10-11 days, with great uncertainty as to whether the operation would proceed at all and with frequent changes in objectives and plans. The deployment to Haiti serves as a contemporary illustration of such a process; the force took off thinking they would jump into combat, but instead air-landed as an invited constabulary force with no opposition.

The AAN envisions a two-tier organization, with combat elements consisting of the small teams described above and support elements. The members of combat teams will be older, more experienced, better trained, more mature, more intelligent and better educated than their support brethren. Combat teams as described will be small and the leader-to-led ratio low; effectiveness, as opposed to efficiency, will be at a premium. In contrast, support teams will be large with the leader-to-led ratio high; the emphasis will be placed on efficiency. Support teams will be located outside the battle space, outside of harm's way.

The AAN will be a small, highly capable force. The Army will have a great deal of time, effort, and dollars invested in each AAN soldier and unit. AAN units must be reusable after only minimal reconstitution. This means few casualties in operations and a high degree of effectiveness and resiliency in AAN personnel across multiple pulses of combat and across multiple deployments.

A number of factors affect individual and unit effectiveness and resiliency. These include:

- Battle intensity and type
- Unit organizational factors
 - Morale
 - Leadership
 - Horizontal and vertical cohesion
 - Unit ethical climate
 - Personnel stability
- Training
- Fitness
- Prior combat experience
- Physiological factors
 - Load
 - Hydration
 - Sleep
 - Nutrition
 - Neuroendocrine and immune status

Gender issues
Personal factors
Intelligence
Education
Prior life experiences
Family stability

This list of factors is not exhaustive, but seems reasonably complete for present purposes.

Intense combat, surprise, and shock degrade combat effectiveness. These are buffered by positive unit organizational factors. High morale, effective leadership, and strong cohesion play a crucial role in improving unit resiliency. A good ethical climate in the unit is one that encourages respect for others and discourages running away or running amok. The importance of both training and fitness are self-evident. Prior combat experience can be two-edged sword depending on the nature and quantity of the experience. Individuals and units have their limits. A moderate amount of experience is good; frequent, difficult operational deployments can wear down both individuals and units. The physiological factors are listed in the order in which they have their effect. Excessive loads wear down soldiers within minutes in combat. Hydration is of obvious importance. Years ago, water discipline meant doing without, now water discipline means pushing fluids to maintain hydration.

Sleep deprivation has a particularly devastating effect on combat effectiveness. We lose 25% of our ability to do useful work for each successive 24 hours without sleep. Sleep deprivation degrades higher order, complex thinking (e.g. situational awareness, the ability to generate common mental models) more than simple mental operations. Speed declines more than accuracy. In its effects upon brain energy metabolism, sleep deprivation degrades brain activation (the firing of neurons) in exactly those areas most critical to tactical and strategic thought. A soldier can fire as tight a cluster with his M16

after 90 hours without sleep (simple task). But he will lose his situational awareness and will no longer grasp who is to his left, right, and rear, how the action is evolving, and who he is shooting at. Friendly fire incidents can develop from this mismatch--the soldier can still put cross-hairs on the target and fire rounds accurately down-range, but he may not grasp the situation well enough to distinguish friend from foe. Especially with thermal imaging, distinguishing friend from foe becomes much more an issue of situational awareness than silhouette recognition.

The effect of partial or total sleep deprivation in degrading speed of performance more than accuracy of performance has a characteristic effect on individual and small unit performance in combat. Take for example, the performance of an M1 tank crew. The tank commander scans for targets, and upon acquiring one, passes it to the gunner, who fires on it. The tank commander must reliably detect the target and accurately distinguish friend from foe, and must do this before the enemy (if in fact the target is the enemy) detects and fires upon him. Thus not only accuracy of decision-making but speed of decision-making is critical to both effective performance and survival. In the sleep-deprived state, the tank commander may maintain accuracy while becoming slower and slower at reaching the correct decision. As long as he is inside the enemy's decision cycle, his performance and the performance of his M1 look nominal. Once the time he takes to make a decision slips outside the enemy's decision cycle, the chances of losing crew and tank go up dramatically. Thus, in real-world operations, the effects of sleep deprivation appear as a long interval of apparently nominal performance punctuated at the end by a sudden failure. It is important to realize that had the commander's response times been tracked in real-time, this sudden failure would appear more as a graceful,

gradual degradation, and adequate warning could have been given before catastrophe ensued.

Gender integration is an issue for the Army. This is particularly the case for AAN operations as they depend upon the effectiveness of small 3-5 person teams, acting in relative spatial isolation. The major difference in physical capabilities between men and women is upper body strength. Upper body strength will have little impact on individual and unit effectiveness in AAN operations, as tasks dependent upon upper body strength are being mechanized. There are cognitive differences between men and women, women being on average slightly better than men on verbal problems, and men being on average slightly better than women on spatial problems. It is not clear whether or how differences in the mix of these abilities make a difference in operational effectiveness. However, even if they did, these differences, although statistically significant in large populations, are actually small differences, and there is considerable overlap in the distributions of these skills between populations of men and women. These population differences in the mix of cognitive abilities should not be too important as teams are constituted of individuals, not of populations. However, there remains a large area, not of individual gender-related differences, but of differences in the social dynamics between mixed gender vs. single gender small groups. Men and women interact differently with each other than they do with members of their own gender. These differences are certainly independent of differences in upper body strength, and probably independent of cognitive differences as well. We should bear in mind that our ability to bond together into groups for the prosecution of aggressive ends is old and may predate our emergence as Homo sapiens. There is evidence of military formations (columns and skirmish lines)

in Neolithic cave paintings. There may be some gender-specific selection for the ability to prosecute aggressive acts. The impact that mixed-gender small group social dynamics will have on individual and unit effectiveness in an operational setting is, at present, unknown, and merits further study.

Beyond unit and situational factors, personal factors play a role in combat effectiveness. Intelligence and education increase effectiveness and resiliency, and decrease vulnerability to combat stress. Prior life experiences, like prior combat experiences, can be a two-edged sword. Experience as a child of abuse, either physical or sexual, makes a soldier more vulnerable to developing post-traumatic stress disorder following traumatic experiences as an adult. In contrast, early love and nurturing, and positive, confidence-building developmental events probably increase resiliency. Family stability, knowing that one's family and loved ones can successfully look after themselves while one is away on a deployment, increases effectiveness and resiliency.

The small (3-5 person) teams, the tip of the spear of AAN operations, will be extremely sharp. However, because the operational demands as outlined in the first section have the potential to exceed human capabilities, the tip of the spear will be not only sharp but brittle. This becomes especially important when we take into account not just one deployment but a series of deployments. It is the purpose of warfighter biomedical assessment monitoring, described in the following section, to manage human resources to sustain operational effectiveness and to predict operational failures before they occur.

Warfighter Biomedical Assessment Monitoring

The Army is planning to digitize the battle space. This means among other things that each soldier will carry a soldier computer, complete with GPS, tactical intelligence, weapons system monitoring, etc., all connected by a local area radio frequency network. Individual soldiers and units will be effectively linked or internetworked. The Warfighter Biomedical Assessment Monitoring will add software and an ounce or two of sensors to the soldier computer, and allow monitoring, assessment, and predictive modeling of soldier biomedical status.

As presently envisioned, the Warfighter Biomedical Assessment Monitoring would include real-time assessment, modeling and prediction of effectiveness, endurance, and resiliency based on:

1) Physiological Factors:

- Physical work load
- Hydration
- Sleep status
- Nutritional status,
- Neuroendocrine and immune status

2) Unit organization factors:

- Morale
- Leadership
- Cohesion
- Ethical climate
- Training
- Gender issues

3) Personal factors

- Intelligence
- Education
- Prior life, including combat, experiences
- Family stability
- Fitness

The predictions from these models would be available in real-time to commanders and medical and mental health personnel for both operational planning and targeted medical and mental health intervention.

Modular subsets of Warfighter Biomedical Assessment Monitoring are in various stages of development. Already in advance development are the hardware and software to measure sleep in personnel in operational settings and predict performance, and computer-based surveys to assess such unit organizational factors such as morale, leadership and cohesion.

The evolving U.S. Army Sleep Management System, a modular subset of Warfighter Biomedical Assessment Monitoring, is already in use as a research tool. It consists of a wrist-worn device the size of a large wristwatch that measures body movement. It has a built-in algorithm to determine sleep and wakefulness from body movement, a mathematical model to predict performance on the basis of the sleep thus measured, function buttons, and a liquid crystal display. With the current version of the device, the user can query the device after he has worn it for a day or two. The device tells the user how much he has slept, and predicts how well he will perform at reasonable complex mental tasks.

The Organizational Factors/Human Dimensions Survey, also a modular subset of Warfighter Biomedical Assessment Monitoring, is already in use as a research tool. It consists of survey items developed and tested during deployments to Panama, Desert Storm, Somalia, Haiti, and Bosnia. The survey measures soldier well-being, vertical and horizontal cohesion, and other unit organizational factors. In Haiti, data collected using this survey was analyzed in theater and fed back to the theater commander within 7 days

of completing data collection. Turn-around time for survey data to be briefed to commanders was reduced to 24 hours in Bosnia. When implemented into Warfighter Biomedical Assessment Monitoring, surveys will be administered at commander's request through the soldier computer, analyzed, and results reported within minutes of completing collection.

Summary and Conclusions

Warfighter Biomedical Assessment Monitoring is being developed as a tool for commanders to use in sustaining performance, effectiveness, and resiliency of individuals and units in AAN operations. AAN operations, as presently conceptualized, carry the risk of exceeding human capabilities. An analogy to AAN is the problem faced by Alexander the Great and the Macedonian Army in terms of sustaining the performance and effectiveness of soldiers on campaigns. As long as the Army was travelling along side its pack animals, the endurance of the soldiers was not an issue since human beings are the most aerobically capable of animals. If the pack animals were keeping up, the soldiers themselves were well within their performance envelope. However, once the pack animals were left behind, as on a forced march, then the endurance of soldiers became the limiting factor in the tempo of operations. It required great attention and skill to move soldiers rapidly on a forced march while having them arrive physically fit to fight. An AAN operation is the cognitive equivalent of a forced march. The information systems and the information they make available (knowledge) coupled with the tempo of movement made possible by air and mechanized land transportation (speed) make the mental endurance of the soldier the limiting factor in operations. Warfighter Biomedical Assessment Monitoring will provide commanders with the tools to ensure that AAN

soldier and units arrive fit to fight and to sustain combat operations for as long as required.

**The Army After Next: Lessons Learned
in American Business Personnel Management**

Mary L. Tenopyr

AT&T Corporation

As is well known, American business is in a state of flux. Increased competition, spurred by deregulation of key industries and globalization of commerce has been a driving force in the marketplace. Concomitant with this flux, there has been a certain amount of destabilization in the field of business human resources. In one company, for example, there may be downsizings in one department and at the same time exhaustive searches for new hires in another department. In general, however, leaders are being expected to do more with fewer people.

New demands are constantly being placed on human resources managers as companies reorganize, even moreso than in the past, the asset value of people. The Army is no stranger to the point of view that people are capital assets. The Army's longstanding research, development, and training efforts relative to people are models that more American businesses should try to emulate. The Army also is familiar with managing under conditions of restrictions on the size of the force and the expectation that more must be done with fewer people.

All in all, the problems facing business and those facing the Army have marked similarities. Despite the fact that the Army has handled such problems well and has devoted considerable human talent to solving them, there may be a few insights that can be gained from a review of current business practices.

The areas in which business trends may be of interest are selection of employees, efforts to promote cohesion and team work, leadership development, use of technology both in training and personnel administration, and changes in the way personnel systems are administered.

In the area of personnel selection, nothing business has done either singly or cooperatively can rival the Army Research Institute's Project A. Certainly the results of the Project A studies have done much to inform business practices in employee selection. For example, The Army Research Institute research on distortion of responses on personality inventories has done much to reinvigorate the use of personality inventories in business. The idea that personality questions may still be useful in selecting employees despite the fact that candidates may distort their responses, either to appear better fit or less well fit, has had considerable influence in industrial psychology. However, it should be noted that some researchers are still dubious about the notion that distorted responses can be useful. Others point out that distorted responses may be an indication that the examinee understands the role he or she is expected to play and that if a person does not understand what personality characteristics are wanted on the job, that individual may indeed be a poor employee.

However, those persons and groups concerned with privacy may be expected to take legal action against the use of personality inventories by employers. Recently Dayton Hudson, owner of Target stores, had some highly visible litigation relative to privacy issues concerning a personality inventory used to select security guards.

Another hindrance to the use of personality inventories can be found in the Americans with Disabilities Act of 1990. That law prevents discrimination on the basis of mental disabilities as well as physical disabilities. A disability is defined as a characteristic that severely limits a major life function. Included among major life functions, according to the Equal Employment Opportunity Commission's guidance on the law, are thinking, concentrating, and interacting with others. Thus, almost any mental disorder may be considered a disability. The Commission has declared personality inventories to be part of the medical examination, which according to the law, can only be administered after a conditional offer of employment has been extended. The legality of a personality inventory is to be determined by an untrained government investigator reading the questions. The question of whether a personality inventory that is valid, in other words job related, as shown by a professional research study can be administered before the medical examination and as a normal part of the employment process has not been tested in the federal courts.

Thus, despite new promise for personality measurement, many employers prefer to avoid potential liability and will not attempt to assess basic personality. However, indirect assessments of personality are on the rise. Realistic job simulations, particularly in the area of customer contact skills, are being used by many companies. These are often done by telephone with a centralized group of assessors making the actual evaluations of social skills on the part of the examinee. The results of these simulations have proved to be job related, and the question of whether a selection procedure is medical has been avoided.

Another Project A finding, the reinforcement of the ASVAB and of measures of cognitive abilities in general, for predicting job success, has also not been received with enthusiasm by business. It is well known that since the Griggs versus Duke Power Company decision by the U.S. Supreme Court in 1971, employers have been reluctant to use cognitive ability tests in hiring and promotion. The employer optimism engendered by the Civil Rights Act of 1964 and its amendment ostensibly protecting professionally developed ability tests soon disappeared in a sea of social activism. Not only the legal system makes testing most difficult, but also the continuing social clamor against testing, led largely by the education establishment and its major union, has not abated.

In the meantime, research in industrial psychology has shown that cognitive ability tests are predictive of success in practically all jobs. Also it has been found that cognitive ability job relatedness is not situationally specific and that new research to prove the job relatedness of ability test results need not be done again every time job duties change.

Despite the clear value of ability testing, more recently ability testing along with achievement testing has become a target for persons with disabilities. Not only are cognitive ability tests challenged but also achievement tests like bar examinations and other licensing examinations.

The Americans with Disabilities Act of 1990 requires employers to grant accommodations in testing to those disabled persons who request them. By far the most frequently requested accommodation is extra time. Most of the requests for accommodations, employers and licensers have found, are for mental disabilities. The number of mentally disabled making such requests has climbed rapidly. For example, the California Committee of Bar Examiners reports that 91 persons requested accommodations in 1990, whereas 305 individuals made such requests in 1997.¹

The question of malingering when mental disabilities are concerned is often the subject of discussions among employers and educational administrators. Also, the question of what qualifications are needed to make accurate diagnoses is a topic of debate that has reached the courts. Jon Westling, president of Boston University, has pointed out that one federal court has allowed diagnoses of disabilities by persons whose highest credential is a master's degree in a field such as education.²

Another aspect of the Americans with Disabilities Act that causes ambiguities for employers is handling employees with bona fide emotional disorders. Whereas the law does not require employers to hire sociopaths or other persons diagnosed as having totally unacceptable social behavior, such as kleptomaniacs, it does require employers to provide job accommodations for other emotionally different individuals.

¹Levin, Tamar, Dyslectic Would-Be Lawyer Sues Over Bar-Exam Timing. New York Times, October 23, 1997

²Westling, Jon, One University Defeats Disability Extremists, The Wall Street Journal, September 3, 1997.

Although federal district court decisions are of little precedential value, it is important to note that at least some courts are ruling in favor of employers in cases involving the emotionally different. In a recent case,³ a federal court ruled that an employee who threatened coworkers could be terminated, partially because the employer had a clear policy against workplace violence.

Another area in which the Americans with Disabilities Act changes hiring practices is in the area of physical testing. Physical tests are allowed, as long as no medical instruments are involved in the tests. For example, the employer may ask a job applicant to run a 50-yard dash and time the performance. However, should the employer use a medical instrument to measure pulse rate as part of the test, the test becomes a medical examination, which can only be given after a conditional offer of employment is made.

The general response of businesses to civil rights issues in the employee selection area has been to avoid rigorous employer selection procedures. Many managers and even some human resources generalists do not understand the value of testing and other forms of assessment in providing a qualified workforce. Industrial psychologists who have promoted cost-benefit analyses, usually called utility analyses, have not been successful in persuading general business managers that a qualified

³ Brieland v. Advance Circuits, Inc., No. 4-96-660 (D.C.Minn. 9/16/97)

workforce saves money. It should be noted that this is only slightly different from the situation in the Army. Although the Army is not charged with making a profit, rigorous employee selection is highly important in ensuring an effective fighting force.

Employers who have been struggling with a less than high quality workforce have been experimenting with various methods in an endeavor called competency modeling. Practically every major company in the country is involved in issues of competency, and there is a large contingent of management consultants who specialize in competency modeling. Competent industrial psychologists such as those who populate the Army Research Institute are seldom consulted.

Although competency modeling is probably one of the most popular programs in American business, for the most part, the competency modeling techniques are poorly developed and the administration of competency modeling programs is poor.

Competency modeling is merely an exotic name for job analysis, a tried and true technique in industrial psychology, dating back to the 1920's. However, most competency modeling in business lacks the rigor that most psychologists put into job analysis. Most business competency modeling procedures involve only focus groups, in which several people sit around in a room and through guided discussion come up with so-called competencies. In normal job analyses using focus groups may be a first step to obtaining tentative job material, which is modified, added to and then later verified by the use of formalized questionnaires given to supervisors and incumbents

and actual intense job viewing. In short, the last step in most competency modeling is merely the first step in job or task analysis. The methods the Army uses now for job analysis are far superior to most of the competency modeling techniques used in business.

It is clear that civil rights issues have great bearing on the activities of the human resource manager in business, particularly when promoting a competent workforce is involved. Possibly the most important lesson learned in business over the past few years is that the intensity of the efforts of the community supporting individuals with disabilities cannot be dismissed lightly. Persons with disabilities are a major part of the potential workforce, are a powerful pressure group, and deserve as much access to employment as is feasible.

The Army After Next would do well to study intensely its policies toward persons with disabilities and become prepared for concerted efforts to afford military employment to at least some disabled persons. In particular, the policy of the Army toward persons with mental disabilities should be examined. Since there are no standard diagnostic techniques for mental disabilities, it might be advisable for the Army to develop its own techniques or set standards for diagnoses. This might appear to be a more appropriate function for the National Institutes of Health or a consortium of organizations of mental health service providers. However, there is so much disagreement among professionals that the American Psychological Association's efforts along these lines have come to no avail.

Certainly, there will be no onslaught of individuals with disabilities trying to enter the military or using disability as a defense in court martial proceedings, yet the disabled must be recognized as a powerful group whose needs must be acknowledged. Particularly, if the country goes into a prolonged period of high unemployment, there may be pressures to accommodate the disabled in the military.

No discussion about civil rights would be complete without some mention of the more controversial aspects of the civil rights movement. I do not have a great deal of expertise in these matters, but I believe I can accurately reflect the consensus in large companies in America.

As for sexual harassment, the message is zero tolerance. Certainly the large civil damage awards the courts have been providing victims of sexual harassment have prompted companies to formulate strict sexual harassment policies and associated training programs. There are two kinds of actionable sexual harassment, quid pro quo in which power relationships are used to coerce an employee into unintended sexual behavior, and the hostile sexual environment, which may involve the use of sexual language, pinups, or other sexually suggestive material in the workplace. The hostile sexual environment is difficult to define, but the best course of action for a supervisor is to prohibit all off color jokes, pictures, anything else that might be interpreted as sexually offensive.

The law on opposite-sex sexual harassment is fairly clear, but there are ambiguities in the legal treatment of same-sex harassment. The U.S. Supreme Court has agreed this session to hear the case of *Oncale v. Sundowner Offshore Services*. In this case, an oil rig worker was subjected to gross sexual horseplay by coworkers. Homosexuality probably was not involved, yet the allegedly harassed worker filed a sex discrimination suit in the federal courts. The Supreme Court must decide whether the law pertains only to harassment by the opposite sex or also to unwanted sexual behavior by persons of the same sex. The case before the court could result in a more definitive decision if clear quid pro quo homosexual behavior were involved. As it stands, there is the possibility that the court can rule that the Civil Rights Act of 1991 mandates a generic code of workforce behavior unrelated to protection against sex discrimination.

As far as homosexuality itself is involved, most employers tolerate it as long as it does not interfere with the operation of the business. Federal law does not afford protection to homosexuals; however, many state laws do. However, most employers are reluctant to extend benefits, such as life and health insurance, to same-sex partners. This may change as some governmental entities, in particular San Francisco, require contractors to extend these benefits or forego the awarding of government contracts.

Also, heterosexual dating of other employees is generally tolerated, except in situations in which one employee supervises the other. In situations of this sort, the

more enlightened companies will transfer one of the parties involved. However, some employers may dismiss one or both of the parties, dependent on the circumstances.

As is evident from the foregoing, the civil rights laws and their attendant issues have had a marked effect on personnel administration in American business. Civil rights can be expected to garner even more attention in the future, since the more important laws now allow both compensatory and punitive damages up to \$300,000 per person. Of late, there have been a large number of multimillion dollar settlements by major employers. Also included in the settlements are large attorneys fees, sometimes approaching half of what was awarded to plaintiffs. There is little reason anymore for lawyers to avoid employment civil rights suits.

Promotion of cohesion in the military is mirrored in business by efforts to promote teamwork. Almost every company has developed a set of core values. Whatever they are officially named, this set of values almost inevitably includes teamwork. One of the major thrusts by business is to reduce the boundaries between management and nonmanagement employees. One major effort by the business community is to have Congress enact the proposed Teamwork for Employees and Managers Act (TEAM). This proposal passed in the last session of Congress but was vetoed by President Clinton. The legislation would allow employers to establish and maintain employee participation programs that address issues of quality, health, safety, and productivity in the workplace. The unions strongly opposed the legislation as a thinly veiled attempt to undermine the legitimacy of existing bargaining units, or to

dissipate any union attempt to organize employees. Thus cohesion in the vertical sense is being hindered by the law. However, many employers are trying to achieve the end of eliminating boundaries between management and non management by a number of actions. For example, stock options, once the perquisite of executives are often being given to all employees. Work groups are often called "teams" and supervisors are referred to as "coaches". In addition, team building efforts of all sorts are being mounted, where unions are not involved. There are even catalogues of exercises of various sorts that employers can use for team building. Consultants in organizational development abound. One program, which heavily employed teams, total quality management, appears to have lost some of its lustre. American business people no longer appear to admire Japanese management as they once did. There are some notable exceptions to this; for example General Electric and Motorola are pursuing well developed quality programs. However, some remnants of total quality management still survive. The use of customer data in evaluating operations still abounds. The use of teams to solve problems and design or redesign programs is still prevalent. However, it should be noted that in some companies that have made heavy use of teams, supervisors are not sending their best people to serve on teams.

Despite the research on teams and cohesion, it is apparent that many teams are not formed or developed according to the best scientific information. Even the simple rules are violated. For example, teams that do not collectively have the job knowledge to do what they are tasked to do are often formed.

One of the biggest problems facing business is that there is in actuality, little guidance in choosing team development methodology. Some of the most widely used techniques have no research support and have never been shown to have tangible benefits.

Another problem with the team building efforts, especially those that involve individuals' revealing personal anxieties and fears, involves questions of professional ethics. There is a fine line between the employers' administering motivational and team building training and the imposition of psychotherapy-like treatments which invade privacy and may cause considerable distress. A number of team building efforts involve the administration of personality inventories followed by required sharing of answers with coworkers. If a psychologist did this, I believe that possible professional ethics charges might be involved. The Army Research Institute is to be commended for commissioning research on programs involving the Myers-Briggs Type Indicator. The conclusion was that millions of persons have taken that inventory in conjunction with training and that there is no evidence the training does any good.

A major problem in evaluating efforts to improve cohesion is the lack of hard data by which to judge team building efforts. In my opinion the use of questionnaires to evaluate cohesion is less than satisfactory.

In leadership development, the most popular techniques appear to be based on 360-degree feedback. In this situation, rating forms are developed involving a number

of leadership characteristics. Then, an individual leader is evaluated by subordinates, peers, and supervisors on this form. Following this the ratings are consolidated, usually by a human resources person or an organizational development consultant. The ratings are fed back in various ways. Often this is done by the consultant working directly with the ratee. Another method is having basic feedback on the ratings done individually with the ratee and then following up with a meeting of the raters and the ratee. The latter method often involves facilitation by the consultant. At the group meeting preliminary plans for developmental actions, including everything from self motivated efforts to modify behavior to formal training, are made. At times, a formal, personalized developmental plan for the ratee is developed. On other occasions, company-prescribed generic developmental programs are invoked.

What characteristics a leader is appraised on are often company-specific. 360-degree feedback appears to be most acceptable to managers if they themselves have had a part in developing the rating dimensions and scale anchors for them. Very often the feedback program is based on a common set of core values for the company or a company accepted set of dimensions of leadership.

Some companies use a 360-degree program in determining compensation or promotion; however, this practice has the obvious problems of persons objecting to subordinates and peers having so much effect on personnel decisions. However, attitude surveys administered to subordinates are often used to make personnel decisions about a leader.

The time-honored assessment center is apparently not used in business as much as it once was. Assessment centers with their monitored simulations, group exercises, and interviews are extremely expensive. Often running several assessees through a center designed for high level leaders takes a week and is very expensive. In these days of increased competition at home and abroad, fewer employers are able to afford costly techniques either for selection or development. Also, many companies are moving from a generalist manager model upon which most assessment centers are based. The centers emphasize such things as decision making styles and leadership in groups. Although there is, obviously, need for the general managerial and leader characteristics in executives, there is a new emphasis, in this technology-driven age, for specific expertise for a given position.

The use of technology permeates most of training in business, as it does in the military. Interactive CD-ROM training is becoming increasingly popular. Even in leader training, technology is becoming more important. One of the more interesting uses of technology in executive training is a computer based program developed by the Center for Creative Leadership (CCL) in Greensboro, North Carolina. Selecting subordinates is an important duty for all leaders, and many leader training program omit this aspect of the position entirely. What CCL has done is develop a CD-ROM-based training program designed to improve subordinate selection skills. Several job candidates are presented, along with information in various categories about each candidate. The trainee is allowed to search the information delving into each category on each

candidate when and if he pleases. During this time the computer monitors the executive's use of information. There is one candidate who is the appropriate one for the given position. After the trainee makes the selection, he or she is given feedback on the decision making processes used, including, but not limited to use of information. Training methods such as these might be useful in making promotion and transfer decisions in the Army.

Large universities are putting even leadership training on the internet. More and more it is seen that only training programs that have the objective of behavioral or cognitive change or providing practice on a skill until it reaches a particular level require classroom training. There is also some experimentation in developing a virtual classroom. Some experts expect the classroom to be feasible within a year.

Regarding the use of technology in personnel administration, it is moving rapidly. The major trend in business is to move, by using technology, as much of personnel administration as feasible, back to the supervisor and the employee. Every major company has an intranet which serves many functions within the organization. The intranet is used as a source of information for the employees. For example, most companies have their personnel manuals, consisting of the rules and policies involving employees on the intranet. The intranet can be surfed to find information about services and where to find additional information about different departments within the company.

Another function served by the intranet is to allow each employee to access and update or change options in areas such as health insurance and savings plans also the employee can obtain job information and apply for transfer or promotion on the intranet. Thus, the employee does much of the work that was formerly done by personnel clerks. Needless to say, this results in considerable salary savings in personnel departments.

Some employers have their attitude surveys administered on the intranet. There is a confidentiality question, but employers have been able to solve that.

Since some employees do not have access to computers, organizations often provide alternate systems, such as conversant systems involving the telephone.

The virtual office from which the employee telecommutes is another innovation made possible by technology. Through the use of the telephone, E-mail, and other technology, employees are able to work from home. Through interactive distance learning, employees are even able to be trained at home. First reports on telecommuting are positive. Employees indicate that they are more productive, save money on clothing and gasoline. However, many employers note that not every employee has the personal discipline to work at home, and some employees miss the social interaction of the workplace. Also, it is difficult to foster cohesion among employees who telecommute.

Another use of technology affecting personnel administration is the human resources information system. Many companies' personnel operations are so similar that they now can buy commercial information systems for managing personnel data. People Soft appears to be the one many major companies are implementing. These commercial information systems have the advantage of not having to be developed from scratch, but they have the disadvantage that they are not easily customized to fit a given company's operations.

The headlong flight into technology is not a panacea for all employers woes. Longman⁴ has pointed out that technology has not had the hoped for increase in productivity growth in the U.S. economy. In fact, since the mid-1970's until today, productivity growth has hovered just above 1 percent a year, with virtually no upward trend apparent in the 1990's. Longman suggests that the increasingly less expensive computing is too often being used for low-value uses that generate very little income. For example, many Pentium chip computers are being used for such mundane tasks as word processing and handling E-mail. It is also possible that the proliferation of "fritterware" such as software for font-beautification and games hinders rather than fosters productivity gains.

⁴Longman, P.J. Is Prosperity Permanent? U.S. News & World Report, November 10, 1997

It is also clear that computers have yet to provide the paper-less office or factory that was promised.

Also, wide use of alternatives to computer processing are being employed. One of the most predominate of these is outsourcing. The word in businesses today is, "Keep the policy; outsource the transactions". Work is often outsourced to vendors or given to contingent workers. Many companies operate internal agencies for temporary employees. Recent retirees or persons who do not want to work full time are placed in jobs in these agencies. At times these jobs are filled by persons who were surplus in their own jobs with the company.

Mainly because of media attention, a final word should be said about genetic testing being used to affect employment and assignment. The Army After Next may find a completely different situation than exists in business today. Despite the American Civil Liberties Union vocal policies and the attention of the newspapers and personnel journals, genetic testing is rarely used in business today. However, with the advances being made in genetics, testing for the susceptibility to hereditary diseases and sensitivity to certain substances may well be an issue in the next century.

In summary, I believe the Army After Next will be faced with a number of issues. Civil rights questions will not go away; the Army of the future may indeed be faced with accommodating groups like the disabled. Developing a cohesive force is still going to be a challenge. Leadership capabilities will still be an issue. Genetics will be a

consideration in Army personnel matters. The Army After next will still be wrestling with man-machine issues, and technology, if used properly, will enhance the fighting capability of our forces.

"Soldierization" for the Army After Next

David R. Segal

Center for Research on Military Organization

University of Maryland

Introduction

Change in American military organization over the past few decades has been described as a shift from an institutional to an occupational format (Moskos, 1977). An institutional military is legitimized by norms and values, while an occupational military is legitimized by market-place dynamics. Among the differences between the two formats is the nature of the serviceperson's definition of his or her role and reference group, which are influenced by accession, training, and socialization processes. Role commitment in the institutional army is diffuse and general. The serviceperson sees himself or herself as a soldier, with a general set of military skills, and the appropriate reference group--the people with whom he or she identifies--is the Army. In the occupational army, by contrast, the soldier sees himself or herself as having a specific job rather than a diffuse set of military duties, and the appropriate reference group is a specific occupational community, the members of which may be in or out of the army.

The shift from an institutional to an occupational format reflects in part an increasing level of specialization in our Army. Mountcastle and Kaplan (1995) have described the proliferation of occupational specialties in the Army between the Civil War and World War II. Eitelberg (1988) refers to this as a shift from "common soldiers" to "technicians." Prior to World War II, most soldiers were expected to have only general soldier skills. However the demands of a (for then) high technology world war in the 1940s produced a division of labor that resulted in the establishment of 532 Army occupational specialties by the end of the war. The proportion of male American military personnel whose jobs demanded only general military skills (including combat skills) declined from 93 percent in the Civil War, to 42 percent in World War I, 34 percent in World War II, about 14 percent during the Vietnam War and the 1973 transition to the volunteer force, and about 17 percent in the late 1980s.

The Army in a modern high technology environment has become increasingly specialized. The product of specialization is units and soldiers who do some jobs very well, but who are not well adapted, in terms of socialization and role definition, for general purpose use. In the Army, specialization was a natural consequence of maintaining a conscription-based or mass-mobilization force, with a singular mission, in a high technology environment (Segal, 1993). Large numbers of people were to serve for relatively short periods of time--too short to train them for multiple complex tasks and realize a return to the training investment. We have moved to a smaller, more career oriented force, in a more mission-ambiguous environment. The self-image of soldiers as specialists, however, has remained, and will be problematic for the effectiveness of the Army After Next if not remediated.

Problem: "It's Not My Job"

While the soldiers' role was defined almost exclusively in terms of war-fighting through the 1970s, American military personnel started participating increasingly in variety of contingency operations in the 1980s. These missions are likely to be a mainstay of Army activity through the first part of the twenty-first century. From the outset, American soldiers have resisted these roles. When the first infantry battalion, from the 82nd Airborne Division, was sent to the Sinai Desert as part of the Multinational Force and Observers (MFO) in support of the Camp David Accords in 1982, over the course of the deployment, declining proportions of the soldiers in the unit believed that the mission was appropriate for an airborne infantry unit (Segal, Harris, Rothberg and Marlowe, 1984:495). Interestingly, when light infantry soldiers from the 7th Infantry Division went to the Sinai five years later, they initially had more positive feelings than the paratroopers that the mission was appropriate for their unit, and those positive attitudes were maintained through the deployment (Segal, Furukawa and Lindh, 1990). However, in 1995, when a composite unit of volunteers, primarily from the reserve components, went to the Sinai MFO, only about half of the soldiers agreed prior to the deployment that the mission was appropriate for their unit, and by the end of the deployment, only slightly more than one-third of the soldiers agreed that it was appropriate (Segal and Tiggle, 1997). In general, while both reservists and active duty soldiers serving in infantry units that had participated in contingency

operations felt that peacekeeping should be done by soldiers rather than by civilians, only minorities felt that the missions should be performed by infantry rather than by military police, and majorities felt that reservists could perform the missions as well as regular military personnel (Segal, Reed and Rohall, 1998).

Infantrymen are not the only American soldiers who feel that peacekeeping should be someone else's job. Early in 1995, I conducted group interviews with soldiers from the 10th Mountain Division when they returned from Haiti (Segal, 1995). In addition to hearing from many combat infantrymen that they were misused because they were doing military police tasks--a theme I have heard echoed by infantry soldiers who have participated in peacekeeping operations for over a decade--I listened to even more deeply felt grievance from gunners and air defenders who felt that they had been required to perform both infantry tasks and military police tasks in Haiti, e.g., conducting patrols and standing static guard, which they (and everybody else) felt were boring.

I pointed out to them that prior to the deployment, even when it was thought possible that the Division would have to land in Haiti facing hostile fire, they knew that there was neither an air defense mission nor a field artillery mission on this operation. The gunners did not bring their tubes with them. I asked them whether, given the absence of branch-specific missions, they would rather have stayed at Fort Drum and trained. With the rest of the Division deployed, they would have had no competition for ranges and other training resources.

They were unanimous and vociferous in rejecting this alternative. They said that they were part of the Division, and if it deployed, it was essential that they go with it. At one level this seemed like diffuse identification with the brotherhood of arms. More specifically, however, it was a concern that if there had been a fire fight, and the other soldiers in the Division got combat patches, they didn't want to be the only soldiers at Fort Drum who didn't get combat patches.

I also asked them whether there were tasks they had been asked to perform in Haiti that were not on their battalion's mission-essential task list: tasks for which they trained. It took some probing to get them to acknowledge that all of the things that they were asked to do were things that they were supposed to be able to do and things for which they trained. They were basic

soldier tasks. These men however did not think of themselves as soldiers first. They thought of themselves in terms of specific MOSSs, and in terms of their specialized units, and their general roles as soldiers were much less salient to them.

I was struck by the contrast between these soldiers and gunners from both the British and Canadian armies with whom I have spoken in the course of my research on contingency operations. The British thought nothing strange about sending an artillery regiment, without its tubes, to Northern Ireland for constabulary duty. The Canadians have done the same with regard to artillery units sent to serve with the United Nations Force in Cyprus (UNFICYP). The British probably still have a more institutional military model than we do (Harries-Jenkins, 1986). However, the Canadian forces have moved explicitly in the direction of managing their force in terms of the occupational model (Cotton and Pinch, 1986). Yet both of these nations seem to have managed to maintain a stronger identification with the diffuse role of soldier, at least among their gunners, than we have.

Problem: The First Deployment

Most armies in the world are home defense forces or function primarily as institutions of domestic social control. Very few nations expect their soldiers to operate regularly as instruments of national policy on foreign soil. The United States differs from most nations in this regard. Since World War II--the period in which our serving personnel were socialized--being forward-stationed or forward deployed during one's period of service was part of the role of the American soldier.

Contemporary soldiers seem surprised by this, and if the current pace of contingency operations is maintained over the next two or three decades, steps should be taken to make sure that soldiers understand that deployment is part of the role.

In the mid-1990s, and the rate of contingency operations was increasing, I did some research to determine what effect higher levels of personnel tempo might have on morale, career intentions, reenlistment intentions, and related factors. I expected to find that the more deployments soldiers participated in within a compressed time frame, the more negative their attitudes would become.

I did find a relationship between deployments and soldier attitudes, but to my surprise, the major decrement in positive attitudes came not with the third or fourth deployment, but with the first. Research on soldiers from the 10th Mountain Division, for example, showed that while over 70 percent soldiers who had never deployed thought it certain or very probable that they would reenlist, fewer than 50 percent of those who had deployed only once gave this response. While fewer than one quarter of the soldiers surveyed who had never deployed reported a decrease in their career intentions between the time that they enlisted and the survey, half of the soldiers who had deployed once reported such a decrease. While more than 40 percent of the soldiers who had never deployed reported that they were satisfied or very satisfied with their current jobs, only 31 percent of those who had deployed once reported satisfaction. And while more than 30 percent who had never deployed said that they would recommend that others pursue an active Army career, this response was reported by fewer than 20 percent of those who had deployed once. In some cases, there were additional negative decrements attributable to additional deployments, but the major difference was between soldiers who had ever deployed, and those who had never deployed.

Conclusion

The greater range of contingency operations we can expect in the early twenty-first century will require our smaller Army to perform efficiently, without placing the burden of these operations disproportionately on a small percentage of soldiers and units. These operations can be confronted most effectively by an Army that has the flexibility to assign to tasks that require basic soldier skills any soldiers or units that can be presumed to have those skills. This should be most of the Army. At the same time, American soldiers should be socialized to understand that even after the end of the Cold War in Europe, being forward-stationed or forward deployed is part of the role of the American soldier.

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Supporting Skilled Decision Making in the Army After Next

Gary Klein, Ph.D.
Klein Associates, Inc.

This position paper discusses factors that may improve skilled decision making in the future and also some factors that could degrade it. The paper suggests some approaches for overcoming these problems. Information technology offers many advantages, but we also need to be aware of some of the limitations and difficulties posed by the technology. My fear is that we will embrace the technology in a way that reduces our effectiveness, rather than increases it. My goal is to discuss ways of using information technology to enable military leaders do a better job.

Perspective: My frame of reference is the July 1997 report on the AAN project. I found this an exciting and challenging document. However, I was surprised by some of the things I did not read in the report.

My strongest concern was about the issue of what the Army After Next will be doing. The report concentrated on military conflict. However, I suspect that the AAN will be doing more work in Operations Other Than War (OOTW) than in combat. Paradoxically, this may increase rather than decrease risk. If we look at the casualty rates for OOTW versus combat for the past 25 years, we find that the risk/soldier is far higher for OOTW. We have lost more in Lebanon, Somalia and Saudi Arabia than in Desert Storm. Granted, Desert Storm may be an anomaly, but we need to take OOTW more seriously. Many decades ago, in the U.S., police departments discovered that there were more injuries and fatalities from interventions into domestic disputes than in chasing criminals. But police officers were spending lots of time on firing ranges, and no time preparing to defuse domestic disputes. To some extent, that has changed in police departments. It needs to change in the Army.

There is also a good chance that when the AAN goes into combat, it will be in an urban environment. On page A-6, the Annual Report on the AAN project asked who will be the Guderian of the information age. To date, I would nominate General Aideed, the Somalian clan leader. His ability to adapt to our superior technology, and to manage the complexities of urban warfare, serve as a cautionary note.

Another concern was about the nature of the battlefield in 30 years. Futurists make a living painting exotic pictures for us. But those who have wrestled with the military procurement

process ought to know better. Certainly, we have some advanced technology applications, such as the use of space platforms, the development of new sensors, the accuracy of precision-guided munitions, the widespread use of night-vision goggles. But we also have examples today of 1960s technology still in use. We have communications gear that makes industry executives laugh. We've been talking about UAVs for more than 25 years, and only now are we starting to introduce them. My rule of thumb here is that 30 years is about how long it will take for the state of the art today to filter into availability throughout the Army. We should focus our vision on current technology, and what it can do for us, rather than speculating too heavily about what will come beyond the current state of the art. The Army can benefit from the pace of innovation in industry, but we need to balance that against the reduced budgets for purchasing that technology. Thirty years is the span from Vietnam to Desert Storm. There were some technologies in Desert Storm that had not been imagined in the Vietnam era, but these were balanced by the many aspects that had not changed very much at all.

Problems: Given this perspective, I would like to identify some of the issues that we need to address if we are to ensure effective decision making in the AAN.

Decision making rituals. The Army has developed a ritualized approach to planning and decision making that involves many decompositions, many steps, and many inefficiencies. The premisses behind this type of approach are rooted in a distrust of expertise and judgment, and a need to consciously deliberate about every important issue. However, as the pace of military operations speeds up, these types of rituals will get in the way. There are times when it is important to compare different options prior to making decisions, but in most cases this type of ritual does not confer any benefits. Research has not shown that such deliberation results in better quality decisions (if anything, the research shows that they result in lower quality decisions). Other examples of these rituals are the careful listing of preconditions for handling a risky element of a plan, even though the level of uncertainty, and the lack of adequate battle damage assessment (BDA), will usually make it impossible to gauge whether these preconditions have been met.

Intolerance for uncertainty. Along with the quest for continual deliberations is the quest for certainty. Information technology offers the promise that uncertainty can be wiped out, like smallpox. However, there are many forms of uncertainty (Schmitt and Klein, 1996). The kind that is easiest to reduce is where data are missing, such as the location of friendly units. GPS will help us track the units. The difficulty is that data get lost amidst information explosions; lost data are missing just as surely as if they had not been received. And there are

other aspects of uncertainty such as low confidence in messages, or ambiguous messages, or highly complex sets of messages, that are not going to be ended by technology. Furthermore, it is likely that the pace of decisions will increase with the pace of data flow, so that the decision makers are going to be operating at the same level of understanding. If we develop a generation of military leaders who are intolerant of uncertainty, and believe that everything will be known within a 200 mile grid, they will be highly vulnerable to the inevitable fog of war.

The nature of C2 in OOTW. Currently, C2 refers to command and control. But in OOTW, C2 comes to mean convince and coordinate. In OOTW there are many rivalries, antagonisms, injustices to work through. Cultural confusions are another source of difficulty for C2 in OOTW (and in combat, for coalition operations), making it harder to know how to convince others. And there are non-military assets to coordinate non-governmental organizations (NGOs). The role of the military in OOTW is thus very different than in combat. However, military leaders are not given sufficient preparation for convincing and coordinating other types of organizations, and as a result, often apply the wrong analogues and the wrong approaches. Military leaders are saddled with inefficient organizational structures for coordinating NGOs, and as a result they may wind up isolated and ineffective. Military leaders often do not have clear criteria for success in very ill-defined tasks. It is difficult to establish the measures of effectiveness in OOTW to determine if a mission is going well or poorly. These measures involve complex social and economic indicators. Together, these factors pose significant barriers for C2 in OOTW.

Belief in sensor-to-shooter types of slogans. The use of information technology in combat will require dramatic changes in command relationships. But we are not yet clear what those changes are going to be. For example, many advocates of the technology describe how it will enable a sensor-to-shooter reflex arc, for faster response times. However, some exercises have shown that this type of reflex arc is unrealistic; the sensor doesn't often have the big picture or expertise to make the call. Targets must be first identified to prevent fratricide. And they must be examined to determine if they have already been identified (and are currently being attacked). Deconfliction of air routes needs to be done. And commanders may not wish to attack certain targets, for fear of giving away indications about the location of forward observers, and/or because they want to shape a battlefield. The result is that commanders are not always eager to cede authority even when the technology permits it. We need to build on these lessons. The danger is in forcing doctrine to conform to technological capability, rather than to sound strategy.

A Xerox mentality about expertise (with apologies to our hosts). When I was a graduate student, I spent considerable time in the library reading articles and making notes on them. Then, in the late 1960s, came a magical moment: the library obtained a photocopying machine. I no longer had to spend all those hours making notes. For a few dollars, I could own the article. But I noticed that I was copying more, and reading less. The more I owned, the less I knew. This analogy applies to information technology. Commanders will be able to have enormous amounts of information at their fingertips. But they don't need it at their fingertips. They need it in their heads. And future warfare is likely to become much more complex, much more demanding. It takes a reasonable amount of knowledge to know what you are missing, and to know the likelihood of accessing useful information in a reasonable time frame.

Procedures that reduce situation awareness. Many descriptions of situation awareness show a flow from the initial data, to knowledge, to information, to understanding. The concept is that military leaders need understanding, not data, and that a structure is required to filter the data, to massage it, to interpret it into knowledge, and then into information, so that it can be presented to the leader as understanding. In most settings, this arrangement makes sense. It shows the need for fusion algorithms, particularly to handle low level data. It guides the use of technicians to handle the raw data, perhaps using simple rules to sort out the inessential data elements and pass forward the relevant items. However, there are times when this concept gets us in trouble. The expertise of a commander usually translates into the ability to see patterns in data, and the ability to notice events that did NOT happen. Expertise usually translates into the ability to know which data elements can make a difference, and to know how to quickly obtain them. The aristocrats of information technology do not delegate low level tasks to relatively unskilled help. They surf the web themselves. We may be reducing a commander's situation awareness by screening the commander from the data, and forcing the commander to rely on the analyses of subordinates. We are preventing commanders from forming their own mental models of what is going on. I am not arguing that commanders should be acquiring all of their own data. I am arguing that there are times when skilled decision makers need to form their own picture, rather than depending on the analyses of others.

The reduction of decision making expertise by information technology. We know what it takes to reduce expertise (Klein, 1997). The research shows that when people are forced to consider excessive data, when they are forced to consider data that are already analyzed (by people with less skill), when they are forced to perform formal analyses of the data, when they are reduced to a passive, data handling mentality rather than an active information-seeking mentality, their decisions will be of lower quality. Unfortunately, information technology tends

to promote all of these impacts. The nature of the technology is to produce information overload. In turn, this requires some sort of pre-processing, which reduces the sensitivity to trends in the data and also results in reduced trust in or feel for the data. Information technology tends to force command post personnel into the job of processing messages, rather than attempting to attack the mind of the enemy commander. The procedures reduce ownership in plans, making the decision makers reluctant to change plans because of the fear that the changes will result in unintended consequences. Taken together, these claims argue that, if we are not careful, information technology will reduce decision quality. There is anecdotal evidence that in some domains, such as weather forecasting and commercial aviation, this is already happening.

Prospects: All technologies are neutral. The way they are used determines whether they are helpful or disruptive. On the surface, we would not expect a technology to be used in disruptive ways, at least not for very long. However, for the AAN, there is a real possibility that information technology will be misused. One reason is that there is a constituency for inserting information technology rapidly, without adequate consideration of impact. A second reason is that our opportunities to learn through trial and error are so limited, because military operations are so infrequent.

However, if we are careful to understand the potential problems with information technology, we should be able to make effective use of them. This section identifies some recommendations for structuring C2 organizations that can do an effective job in the AAN. The emphasis is on the use of information technologies, but issues such as OOTW are also addressed. The key to these recommendations is to organize around expertise.

The AAN will need to evolve strategies for rapid planning and decision making. While information technology can speed up the decision cycles, the improvements can only go so far before running into the limits of the decision makers and current doctrine. For the AAN, the pressures for rapid planning and decision making will increase. In response, we can expect that planning and decision making strategies will change. The challenges to using information technology are to help decision makers spot leverage points, detect problems, seek their own information, build their own mental models, and adapt plans. If the AAN can achieve these impacts, it will have harnessed the potential of information technology. The result will be seen in changes in decision making and planning strategies. Recognitional decision strategies (as opposed to analysis and deliberation strategies) depend on the expertise of the commanders, and can increase tempo without necessarily reducing decision quality. If the AAN is able to capitalize on recognitional decision strategies, it may achieve important gains in speeding up the

decision cycle. Planning strategies can be improved in several ways: by cutting through the procedures for excessive detail during initial plan development (because plans become obsolete in combat almost as quickly as they are developed, so what is needed from an initial plan is a platform for adaptation) and by speeding up the development and dissemination of the revised plans. Here, information technologies can provide support for initial plan construction, for replanning, and for plan dissemination. In order to accommodate such changes, the AAN will need to promote changes in doctrine, training, and support. It makes little sense to import information technologies in order to maintain inefficient practices. While we do not want to mandate artificial strategies of planning and decision making, the evidence suggests that recognitional and naturalistic strategies are more consistent with human cognition. Thus, the AAN may be able to use information technology to improve performance by overcoming the artificial restrictions and limitations of the Army's current procedures.

The AAN will need to organize command posts around the expertise of the decision makers. That means making breakthroughs in the way information is routed and displayed within command posts, and between command posts. It means re-thinking the time-consuming briefing rituals with their painfully low information exchange rates. And it means developing far more effective procedures for active information seeking, to promote better situation awareness at the top, rather than the current practice of message handling which requires passive review and distribution. There are four aspects of re-organization to be considered here: the organizational structure, the staff size, the management of distributed planning, and the capability for OOTW. With regard to organizational structure, the current Napoleonic configurations are turning out to be inefficient. New roles need to be defined, and new structures need to evolve. The AAN will have difficulty making these evolutions in the face of existing billets and specialty paths. If it allows itself to be straightjacketed by current manpower, personnel and training practices, it may find itself unable to keep up with events on the battlefield. Hopefully, the AAN will learn how to re-organize command posts around the needs of the central decision makers. The next issue is size. The combination of overstaffing and information technology may prove unacceptable. Information technology may only be effective in future command posts if the number of staff members is radically cut. In addition to re-organization, the AAN may find that it can dramatically reduce the size of the command posts. One of opportunities emerging from information technology is to reduce staff size. This has economic benefits, but it should also result in faster decision cycles. In addition, the AAN will probably find out where it can broaden the span of control (and where it cannot), and will also learn how to telescope echelons to reduce layers of control (e.g., by incorporating a brigade command post into a division during certain types of missions). The third issue is management of distributed operations. The AAN

will need to evolve practices for using information technology to achieve this. Currently, certain phases of planning can be distributed, and others require the planners to be co-located. The AAN may find ways to overcome the needs for co-location. The fourth issue relates to OOTW. Existing command post structure and operations need to be radically reconfigured for OOTW, in order to achieve the C2 requirement to convince and coordinate. The AAN may benefit from studies of settings such as disaster relief operations to discover organizational structures and technological adaptations that are more effective.

The AAN will need to expand its cross-cultural expertise. The increasing frequency of coalition operations, both for combat and OOTW, require a better understanding of cultural differences in decision making and negotiations. The AAN will be able to draw on resources to improve its expertise in managing these types of cultural differences. Such resources may include the development and use of cultural templates to anticipate decision making and planning styles. (Cultural templates make use of the fact that a small number of dimensions appear to account for most of the difference between cultures with regard to decision making and planning styles.) Another resource would be to rely on information technology to accommodate long-range consultations at critical times. Yet another would be for the AAN to draw on the cultural diversity of the United States to identify individuals from the same or compatible cultures (as determined by cultural templates) to augment specific operations.

In conclusion, the prospect exists for dramatic improvements in military performance for the AAN. One of the driving forces for achieving this potential will be to focus on the expertise of commanders and their key staff members. If the AAN accepts the latest developments in technology, regardless of their impact, and tries to insert these into the current command structures, the results may be disappointing. On the other hand, if the AAN is able to ensure that the information technology it obtains will enhance, rather than interfere with the expertise of the key decision makers, and if it is able to adapt its doctrine and organizational design accordingly, then we can expect to see it dramatically widen its lead over future adversaries.

Automated Reasoning for Asymmetric Warfare Simulations

Dr. Paul E. Lehner

**Chief Scientist, Information Systems and Technology Division
Washington C3 Center
The MITRE Corporation
Reston, Virginia**

Dr. Joseph Psotka

**Research Psychologist,
U.S. Army Research Institute
Alexandria, VA**

ABSTRACT

In this paper we examine the use of automated reasoning for future simulations and wargames. In particular we focus on the notion of asymmetric warfare and the technical challenges that imposes on developing simulations that exhibit reasonable asymmetrical warfare behaviors. Our basic conclusion is that simulation of entities pursuing asymmetric warfare options cannot employ the same knowledge rich approaches currently being used to engineer adversary behaviors; since the objective of asymmetric warfare is to find innovative ways to defeat us, heretofore unanticipated. We can't knowledge engineer what we don't know. We propose an alternative approach that uses knowledge weak methods to generate innovative asymmetric warfare behavior in simulations that could also be used, in the longer run, to support development of a more complete asymmetric warfare knowledge base.

Introduction

A concern about future warfare is that our potential adversaries will not attempt to defeat our forces, but will concentrate instead on finding innovative ways to prevent us from achieving our objectives without directly attempting to defeat our forces. Their strategy and methods will be asymmetric relative to ours. Among other things, they will focus on emotional/cultural effects on our will to fight. This will be particularly true in operations other than war, where the adversary may employ various tactics to undercut US commitment, impact international political support, create discontent in the country of the

operation, etc. The situation becomes even more difficult if our adversaries have very different values than we do (e.g., different value for loss of life).

To win such conflicts, we need to be prepared for a diversity of asymmetric attacks. In this paper, we explore some ideas on how automated reasoning and simulation techniques can be used to help us be more prepared. Specifically, the next few pages briefly review the current state of automated reasoning and simulation techniques; our ability to simulate complex reasoning that we yet don't understand, including emotional reasoning; as well as a couple of general technology trends. Based on this information, a specific proposal is made for automated reasoning and simulation research as it relates to asymmetric warfare.

Simulations

Simulations can be defined as projections over time of the consequences of proposed action sequences (where the algorithm to project consequences is usually referred to as a model). Today, most simulations are either computer-based executions of a pre-scripted set of actions or interactively controlled by operators and players who select the actions of a small number of entities embedded in the simulations. Recent advances in simulation technology however has resulted in simulations that contain thousands of entities many of which operate nearly autonomously. A recent example of this is the recent Synthetic Theater of War (STOW) advanced concept technology demonstration.

Simulation can be used for a variety of purposes. In training they provide a mechanism for creating realistic training environments. In *wargaming* (a process of projected possible friendly and adversary actions and counteractions in a hypothetical or current conflict) simulations can be used to project possible futures for different operational concepts and courses of action. Even in execution monitoring they can be used to project the likely evolution of the current situation.

In all of the various uses of simulations, it is essential that the entities embedded in those simulations behave intelligently and realistically. That is to say that the simulated entities must reflect realistic automated reasoning.

Automated Reasoning in Simulations

Broadly described, the term automated reasoning describes techniques that either emulate human reasoning or exhibit "intelligent" problem solving behavior even if it doesn't emulate human reasoning. Although the term "automated reasoning" is often associated with the discipline of Artificial Intelligence, there are actually a diversity of disciplines that provide "models" that can be embedded in automated reasoning systems; including decision analysis, operations research, statistics, behavioral decision theory, and cognitive psychology.

In simulations automated reasoning is generally attached to simulated entities (soldiers, commanders, civilians, ...) so that these entities will behave in a situationally appropriate (i.e., make good decisions) and/or a human-like manner (i.e., make decisions that people might make, including the types of "mistakes" people make).

Current technology for representing human decision making in simulations is limited. For the most part, autonomy is limited to individual platforms (e.g., tanks) and small units (tank platoons). Higher level command entities (e.g., brigade command) are still controlled by human operators. Nevertheless, it seems reasonable to expect that over the next decade simulations will be developed that can autonomously select tactically reasonable actions at all echelons.

For purposes of this paper the various approaches to automated reasoning in simulations can be characterized by two general dimensions: situation-adaptive vs. human-like and process vs. behavior representations. Each of these are discussed below.

Situation adaptive vs. human-like

By situation adaptive we mean behaviors that are appropriate for the specific circumstance the (simulated) entity finds itself. Situation-adaptive entities endeavor to select the "best" behaviors for each situation irrespective of whether that behavior reflects a specific doctrine or command tendency; whereas human-like behaviors are specifically designed to exhibit human tendencies, biases and weaknesses. Although "best" and human-like are not mutually exclusive (fortunately!), it is important to realize that simulated entities can be intentionally designed for either.

To illustrate this distinction, consider a case where a learning algorithm is being employed to learn the behavior of individual soldiers under fire. Two types of feedback are available to guide the learning algorithm; actual soldier responses under fire (such as in a virtual reality simulation) or the value of various outcomes that depend on soldier behaviors (e.g. relative attrition). In the first case, the simulated entity will act more and more like the person it's emulating (e.g., duck under fire) whereas in the later it will learn to act in a way that maximizes outcome irrespective of human reasonableness (e.g., continue firing irrespective of personal harm).

Process vs. behavior representation

There are two basic approaches to simulating decision making behavior. In the *process model* approach the emphasis is on modeling *how* people make decisions and solve problems. The objective is typically to develop software that employs the processes people use to solve problems. Processes can be modeled at both the symbolic and subsymbolic levels. For example, most expert systems are symbolic level process models, since they are intended to mimic human expert problem solving; while most neural networks are subsymbolic process models, since the intent is to mimic human

perception and decision making by employing neural processes that are similar to the human brain.

An alternative approach is to develop models of human behavior that do not attempt to model human cognitive processes. One instance of this is the so-called "normative + bias" approach where the focus is to model both the best possible decisions (normative solutions) and the "mistakes" that people often make (i.e., their biases). Even though such models endeavor to predict the types of decisions that people are likely to make, no attempt is made to directly model how people make decisions. The objective is to model human behavior, without modeling cognitive processes. Most of the research in the psychological field of Behavioral Decision Theory adopts this approach.

For the most part current entity-level simulations utilize process representations where the behavior of simulated entities have been directly knowledge engineered to exhibit doctrinally prescribed behaviors or behaviors that are intended to reflect the result of simulated human cognitive processes (e.g. Recognition – Primed Decision making where commanders use situation awareness to define a course of action that is a composite of their personal experiences in similar situations).

Later we will argue that for asymmetric warfare the focus should shift dramatically from process to behavior representations. First however we need to examine a couple of general technology trends.

Technology trends

In examining research options for automated reasoning in asymmetric warfare there are several technology trends to note.

From information infrastructure to decision support

In the last decade we have seen the emergence of the information infrastructure where access to large amounts of potentially relevant information is readily available. This is true not only of the civilian infrastructure (e.g., World Wide Web); but is (will be) also true of Battlefield C2 systems (e.g., First Digitized Division and the tactical internet). Now that "information" is readily available to (and often pushed onto) users, people are naturally beginning to ask the question "What do I do with all this stuff?" In short, decision makers are asking how to orchestrate the application of this emerging information infrastructure to support decision making. This seems to be particularly true of military commanders who deal with major life and death decisions based on what the infrastructure is providing. As a result of this trend, there is a growing interest in the military user community in decision support systems, cognitive systems engineering, cognitive ergonomics, and related disciplines that address the user-focused application of technology.

One important instance of the trend described above is the almost explosive recent interest in *visualization tools*. The idea here is to use compute intensive large screen displays to present large amounts of information visually. This includes battlefield displays (both 2D and 3d), data visualization, geographic displays, immersive virtual reality, etc.

Computation vs. Knowledge

In AI there are two general approaches to developing systems that exhibit intelligent problem solving behavior: computation-based and knowledge-based. Knowledge-based approaches emphasize the importance of capturing and encoding human knowledge. The development of knowledge based systems usually involves a substantial amount of "knowledge engineering"; where the engineer must work with human experts to articulate and summarize relevant expertise. Most of the expert system work in the 1980's is described as knowledge-based. Computation-based approaches attempt to avoid the knowledge engineering work by replacing knowledge with intensive computation. Typical of this genre are chess programs, which contain very little encoded chess knowledge but can quickly search through billions of possible move sequences. The general trend in the last few years has been toward finding computation-based approaches to solve problems wherever possible. This is because improvements in computation hardware and storage have been dramatic, while improvements in knowledge-based systems technology have been much slower.

An interesting variant of this trend has been the interest in data mining; which may be viewed as an effort use intensive computation and storage to infer domain knowledge - thereby avoiding some knowledge engineering effort. An interesting activity along this lines is Latent Semantic Analysis (LSA). LSA may provide an interesting convergence of these two trends, since it offers a way of creating undigested, non-knowledge - engineered text in great abundance. Compiling many alternative courses of action in text form to many different situations was an academic exercise with little value in the past. But, today, data mining and search techniques can convert these static text bases into dynamic knowledge bases. Using LSA - like searches, the kind we all perform on the internet routinely, valuable courses of action can be extracted from the texts and used in a dynamic knowledge - based way. LSA selects the best alternatives to the current situation description, in a way that can mimic Recognition Primed decision making.

Automated Reasoning for Asymmetric Warfare Simulations

Asymmetric warfare is an approach defeating an adversary with superior forces. Fundamentally this means finding innovative ways in which to defeat the adversaries will or ability to fight in spite of the superiority of his forces. The objective of an asymmetric attacks can be psychological (reduce will to fight), informational (information warfare), political (deny support of allies), infrastructure (disrupt services), economic, etc. Although the target of the attack may be unconventional, the method of attack may be very conventional. A conventional battlefield operation may be intentionally designed to

have unconventional impacts. For instance, it was recently reported in the public press that among North Korea's objectives in any attack on South Korea would be to reach a specific quota of American deaths, because such a loss of life would undercut the US will to fight.

If the objective of asymmetric warfare is unconventional effects, then we need methods that help us anticipate such effects and plan to defend ourselves against asymmetric attacks. Simulation technology is an obvious candidate to support such an activity. However, simulating adversaries pursuing asymmetric warfare objectives is substantially different from simulating adversaries in conventional warfare. In the later case, we can knowledge engineer realistic and reasonable adversary entities. In the case of asymmetric warfare we cannot. We cannot knowledge engineer warfare options which we heretofore had not anticipated. The objective of asymmetric warfare simulations is to uncover knowledge we do not have, not to encode the little knowledge that we do have.

All this implies that the process modeling and knowledge intensive approaches are out, which in turn implies that alternative approaches should be explored. An alternative approach is to exploit the technology trend noted above, to find ways to get around the difficulties of knowledge engineering by exploiting computational power. Specifically, we propose

- (1) Initiate a research effort to develop/define the "chess game of asymmetric warfare", where the game reflects our best knowledge and research on the various effects (psychological, political, social, economic, ...) of various events. The term "game" here is intentional. The intent is to define a game board in which both human and automated reasoning techniques can play out various warfare options.
- (2) An important aspect of defining the game is modeling of adversary (and other agent) values. Variations in values can have a dramatic impact on outcomes. Collectively we are frequently amazed at the lack of impact that economic and other sanctions have on our adversaries behaviors, probably because we place considerably different values on the harshness those sanctions cause. The chess game of asymmetric warfare should allow for considerable diversity in values; and should show how value changes can impact outcomes. Value modeling is an important research topic.

Expanding on this a bit, it is important to note that although human performance in combat is widely acknowledged to be the most important factor in victory and defeat; there is only indirect evidence of this in most simulations. The variability due to human performance factors is left out of many models. Beyond the effects of sleep deprivation and some effects of stress, military systems and simulations are not designed to model human performance. We need better methods for simulated representation of human performance variability including psychological, social, and cultural responses to the stresses of war fighting. As noted above, simulations have begun to incorporate human behavior and cognition, but they do not include emotion and personality factors. This is simply not adequate for asymmetric warfare modeling.

We also note that understanding the cognitive and emotional analyses of the complex state we now call "will" is important for leadership development. Collapse of the enemy's will constitutes dominance. Collapse of our own constitutes defeat. We need to better understand the mechanisms and psychological processes that constitute destruction of the will. And to prepare our leaders for asymmetric warfare, we need to develop training environments (e.g., simulations) that reflect our understanding of the concept of "will".

(3) Develop automated reasoning "weak methods" to play the role of an adversary when playing the game. This is comparable to chess programs which employs weak (i.e., knowledge poor) methods to search through a large space of options. The net result is a program that knows very little about chess, but plays at like a grandmaster. The objective for asymmetric warfare simulation is the same; find methods that search through a large space of asymmetric warfare options to find ways to defeat proposed friendly plans that we did not anticipate.

It should be noted that developing such weak methods is by no means a simple engineering task. Although such search methods have proven adequate for chess, they are not adequate for more complex games (go, most board wargames, ...). In this endeavor it would be important to design the "game" of asymmetric warfare in coordination with the development of automated reasoning procedures for playing the game.

(4) If (1) - (3) are achieved, then the resulting capability can be used for two purposes. First, to support examination of various operational concepts and courses of actions (i.e., as a decision support tool). Second, as a research tool that allows us to examine and learn about various innovative asymmetric warfare options. We would be data mining for asymmetric warfare knowledge.

(5) Given the success of the preceding steps (which is not a certainty but appears doable) the weak methods can be gradually refined and compiled into strong knowledge engineered computationally simpler "rules" that can be implemented directly in existing simulations and war games such as STOW, Eagle, and WARSIM, and their future derivatives..)

Conclusion

Overall we propose that for simulation of asymmetric warfare the focus needs to be on going beyond our current warfare knowledge. This implies a simulation capability where the embedded automated reasoning capabilities find innovative options, despite a lack of asymmetric warfare knowledge. In short, it uses weak methods and a lot of search. We

believe the program we have in mind is quite feasible and that an initial implementation could be achieved in a few years.

Finally, we would like to note that we are definitely not proposing a single all encompassing simulation that models all aspects of asymmetric warfare. One simulation does not fit all. For training, simulations should match specified training objectives, instructional strategies, and desired learning/training outcomes. Similarly for operational decision support different types of simulations serve different purposes. For outcome prediction highly detailed simulations tend to be inappropriate (adding detail also introduces new sources of error). On the other hand detailed simulations are clearly necessary for immersive plan visualization.

Human Behavior Modeling and Simulation in Support of the Army-After-Next

Richard W. Pew
BBN Technologies
GTE Internetworking
Cambridge, MA

Introduction

On the time scale that this workshop is chartered with forecasting, we can expect exponential impacts of the information revolution on the military services. Already the military is embracing the world wide web. Military manuals describing doctrine, RFPs, training manuals, command and control data are routinely available on either secure or open internet links. I have recently worked with a DARPA project the goal of which was to provide extensive on-line distributed information and decision support to joint task force crisis-action planning teams. In connection with this project the services demonstrated joint Navy-Air Force distributed collaborative development of an Air Tasking Order among the U.S.S Kitty Hawk at sea, and Air Force planners at Rome AFB and Hanscom AFB. I am currently working on an Electronic Mall for the Defense Logistics Agency (DLA) that promises to make available for military purchase on a universally accessible (to the military) web page, via IMPAC credit card or Milstrip purchase arrangements, any of 3.5 million items that are managed by DLA. It is scheduled to be in operation in January 1998. On a somewhat longer time frame I am working on the human interface issues in the design of an automated logistics planning system, the goal of which is to replace the details of human planning with genetic algorithms for the scheduling, forecasting and tracking of the transportation, supply and maintenance requirements associated with the logistics tail of modern warfare. These kinds of projects open up entirely new horizons to the meaning of information warfare, both in terms of promoting the benefits to friendly forces and for protecting against enemy interference.

As is suggested in "Knowledge and Speed," the 1997 Annual Report of AAN, "...present day tools and perceptions only lead to more questions about the effects of technological change, the human and organizational dimension of future war and the character of warfare itself." The report goes on to suggest that the kinds of predictive attrition models that represent the main available analysis tools today tend to predict that the side with bigger, more powerful forces will win battles. In contrast to this it argues that success at the strategic and theater levels will increasingly depend on knowledge and other intrinsic advantages rather than on who has the "biggest stick." We lack the analysis tools

to forecast adequately the impact of the information revolution on the war-after-next.

Because of these difficulties -- the costs in money and time of live military exercises, the lack the adequate analytic models, the lack even of adequate performance indices to track success and failure in this new information-rich world -- it is going to be essential to engage in extensive model and simulation development to produce analysis and training tools. Judging from the large investments in modeling and simulation, the military has already realized this. However, modeling and simulation of human behavior must be the keystone of such models in the future and human behavior modeling has not received its proportionate share of this funding. More importantly, the funding it has received, with occasional exceptions, has been uncoordinated and lacking in focus.

State of Human Performance Modeling

Human behavior modeling has a long history dating back to the World War II when there was interest in predicting the behavior of an anti-aircraft battery operator who slued the servo-driven gun-mount to aim at potential targets. The goal was to develop an control-engineering model of the human operator so that the feedback controller on the gun mount could be optimally designed (Tustin, 1947).

Human performance models today predict most effectively when the environmental or procedural constraints on performance are so severe that behavioral alternatives are very limited. We can very successfully predict the perceptual-motor tracking behavior of an individual where the only goal is to minimize tracking error, but do very poorly when that person has the freedom to drink a glass of Chianti or eat spaghetti in idiosyncratic ways.

Where human performance modelers have been successful is where the need is for network-based simulation models that carry out specific tasks but that do not operate as autonomous human behavior representations. These are cases where the modeling of selected parameters, such as visual detection, attention, decision making or workload can make an analytic contribution to eliminate design alternatives before prototyping, narrow the range of prototypes that must be tested or contribute information that suggests the precise conditions to evaluate during T&E. In the Army good success has been achieved using models of this kind as a part of the MANPRINT evaluation process.

Human performance models have also been in use in distributed interactive simulation (DIS) for training for several years. However, the mode in which they have been used mostly is as a semi-automated force. That is, a human is given control of multiple enemy units and provides high level direction that is then carried out automatically by the software. Such models are built in ModSAF or, more recently in the CCTT architecture. Mostly the

simulation "knows" how to carry out maneuvers and form up on the battlefield. The detection, identification and firing routines assume complete knowledge and nearly ideal performance on the part of the vehicle crews. Models of dismounted infantry are just beginning to be explored in CCTT and their representation of human behavior is pretty crude. Each is designed to execute on a task-by-task basis. They do dumb things. Having no memory, they peek around the corner of a building and collect situation data. Then, when they return to that corner of the building they start all over again. Having no auditory attention to take account of sounds they hear, they ignore the cues provided by approaching footsteps or localized rifle fire.

Today, and in the future, models are being considered for a wider and wider variety of purposes. In addition to systems analysis and design, they are being used for evaluating system performance during system acquisition and doctrine development, for representing the behavior of enemy or collateral friendly forces in order to accomplish realistic training, and for simulating the implications of alternative courses of action for the battle staff. For most of these applications the need is for integrative models that produce behavior that mimics the behavior of real soldiers on the battlefield; Soldiers in moving vehicles, dismounted infantry, soldiers operating in the aggregate in larger units and the behavior of intact corps or battalion level organizations.

However, the gulf between available models and the military need is enormous. With only a few exceptions, the models that are available today in the research community are not integrative cognitive models in the sense that they are capable of mimicking the observable behavior of individuals on the basis of sensible, intelligently reasoned actions. They tend to (1) reflect individual human performance capacities and limitations, (2) predict human behavior in very constrained experimental paradigms such as choice-reaction time.,

There are some organizational level models that actually attempt to mimic the outcomes of particular organizational structures without modeling the individual people in the organization. (Carley and Prietula, 1994) However the application of most organizational models to date are designed reflect comparison of very selected performance parameters like the average number of communication steps from input to output as a function of the structure imposed on the organization.

In the summer of 1996 the Defense Modeling and Simulation Agency (DMSO) commissioned the National Research Council (NRC) to undertake an 18-month study of the state-of-the-art in this kind of human behavior representation. I am fortunate enough to be the chair of the panel established by the Human Factors Committee of the NRC for this purpose. The Panel has issued an interim report (Pew and Mavor, 1997) and has plans to submit a final report that should be available in March 1998. The comments in this paper reflect not only my own knowledge, but also the collective expertise of the Panel.

The opinions expressed are my own and do not reflect the views of the NRC or the Panel, beyond those presented in the interim report.

Modeling Needs

For training (distributed interactive simulation) and decision aiding in real-time environments it is important to represent physical movement and detection and identification of enemy forces. Actions should be based on "realistic" cognitive activity, such as decision making and communications; when they originate with a simulated unit they should be interpretable as the result of sensible plans and operations. Teams should manifest the range of behaviors required to be consistent with the degree of autonomy it is assigned and be able to respond to expected and unexpected threats.

I sincerely believe, and the Panel has taken the position in its Interim Report that the next level of improvement in HBR requires that the models be based on psychological and sociological theory. For individual combatants, it is important to represent the processes underlying the observable behavior. The Panel has considered sensing, perception, situation assessment, working memory, long-term memory, decision making and task management as the kinds of processes we felt were important. For organizational level models it is important to represent the command and control structure as well as the procedures by which information is communicated.

While I believe this, I must reveal that my belief is an act of faith. I know of no real evidence that models that are based on psychological or sociological processes outperform those that are not. This is not even a question for which a meaningful quantitative evaluation would be sensible, since it could always be argued that one or the other model used in such a comparison was not as good as it could be.

The issue is even deeper than this. Suppose we assume that models with psychological or sociological content are better. Then the question becomes: which kind or kinds of processes will provide the most leverage for improving human behavior representation at the level of observable behavioral outcomes? Where should we place our human behavior simulation research effort to provide the greatest good for the Army-After-Next?

Unfortunately we have faced this issue before and continue to face it in other arenas. It is very similar to the simulation fidelity issue. Given the inevitably limited polygon drawing capabilities of contemporary graphics systems, where should we place the resources for providing visual simulation fidelity in order to maximize the ability to utilize cues derived from the simulation for realistic decision making, either in a design evaluation setting or a training setting? If you ask program managers or subject matter experts, they will tell you they need all the fidelity they can get, but this is not a helpful response in a limited resource environment where design decisions involve trade-offs among a set of desirable visual realism goals.

Recommendations

I have no solution to offer to these dilemma, but I will make a couple of suggestions that might help get us there. First, we need to follow the lead of the original SIMNET developers who made the strategic decision that the purpose of their trainer was to train tactics. They would make all simulation fidelity decisions in support of the specific purpose of training tactics. For example they opted not to mimic realistically the actual task of loading a round into the barrel of the MA-1 cannon, but rather only to simulate with button presses the sequence of activities together with sensible estimates of time required for each. In every human behavior simulation we should first decide the purpose of the simulation and the goals of the simulated operators and make judgments about what kind of behavioral processes to include based on these purposes and goals.

On another dimension, I believe that the SIMNET developers made a mistake. As a matter of policy they insisted that no performance metrics be collected. Their argument was that real soldiers learn from their mistakes on the battlefield and from who won or lost in an exercise, not from detailed performance data. However they neglected a second purpose of such metrics, namely the capability to evaluate how successful the simulation technology was fulfilling its purpose. We need to start now designing and collecting outcome-based performance metrics that will provide assessment data about the comparative success or failure of existing and future human behavior simulations. These need to be general enough to encompass the broad range of applications to which such simulations might be put. We are not looking for improved humans, only improving the match between simulated and real human behavior. In the case of DIS simulations, how well do they perform in comparison with their human counterparts? In the case of constructive simulations, how well do they perform in relation to their counterparts in comparable live exercises? Think of them as we think of national economic indicators. They should be collected routinely for every application and, over time will help provide indices of the level of improvement that is being achieved by new technology or new model designs.

There are two additional initiatives, one short term and the other longer term, that should be undertaken in support of improved analysis capabilities now and into the decade-after-next. First, as suggested in our Interim Report, individual services should pick a human behavior modeling problem they consider the most significant for understanding the potential impacts of information warfare. Then they should support a significant and sustained program of research to accomplish that single-minded modeling goal. The researchers should not start from scratch. They should start from one of the promising modeling frameworks, Soar (Laird, Newell and Rosenbloom, 1987), Act-R (Anderson, 1993), EPIC (Kieras and Meyer, 1997), MIDAS (Corker and Pisanich, 1995), and OMAR (Young and Deutsch, 1997). that have been

developing in recent years. The interdisciplinary project team should include cognitive psychologists, computer scientists who are knowledgeable concerning the contemporary literature and modeling techniques, and specialists in military doctrine and procedures of the domain to be modeled.

Second, in the long term we need to expand the range of psychological and sociological process models that have the potential to be synthesized into integrated behavioral models. This should include fundamental research undertaken from the perspective of its modeling potential and keeping in sight the potential military relevance of the processes being modeled. Only with such far reaching research now will we be ready for the information-warfare-after-next.

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Battle Command of 2020 and Beyond

by

BG(R) Huba Wass de Czege

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“Man is the fundamental instrument in battle.”

So wrote Ardant du Picq in his 1868 “Battle Studies” having drawn on his own experience and that of the experienced officers of his generation in France. He also echoed Sun Tzu (500 BC), Vegetius (400 AD), De Saxe (1750), Frederick (1753), Napoleon (1800) and Clausewitz (1830), among others. Having some experience with the recent past and present and having participated in four years of studies of the future, I see no reason that this will ever change. Warfare will remain a nasty, brutish, and fully human affair. Uncertainty, fear, and friction will be the medium of battle. Some people will exceed our expectations and others will disappoint us in unpredictable ways. This article is about one dimension of what can be done to improve human performance in an age when small numbers of people will dispose of previously unimaginable combat power in situations requiring both decisiveness and discrimination. This makes the study of battle command a vital subject.

Battle command is the art and science of optimizing outcomes in battle. It involves forming people into organizations with a common purpose, direction, motivation and continuity. It means engaging them in missions involving danger, destruction, and deprivation. It means making decisions during stress and uncertainty , and having “teams of teams” execute these decision with dispatch, commitment and audacity. As the trends of technological evolution place ever more potent and costly means at the disposal of smaller organizations, and as discriminate use of this greater power becomes increasingly important the more vital it is that the human contribution to battle outcomes is optimized.

A revolution in Battle Command.

What we are seeing in current Force XXI experimentation is but the beginning of a revolution in battle command. We will rapidly get beyond the current challenges of integrating functionally “stove piped” information systems. And we will add the layered sensor arrays and analytical nodes to match the rapid growth in precision fire power, maneuver, and protection technology. As a result, there will be more knowledge about “ground truth.” This knowledge will be better analyzed, processed, shared, stored, and presented. This will result in quicker decisions and better plans more reliably and faster communicated. Information technologies will have an impact on soldiers, leaders, staff operators and staff planners, organizational arrangements, span of control, control measures, and command and control philosophies. The principles of battle command will not change, but the methods will be radically different.

Art and Science.

Battlefield decision making and control of units will become more scientific. But leading soldiers and units to success will remain largely in the realm of art. What differentiates current and future battle command from the timeless challenges is the scope, intensity, and tempo of contemporary and future operations brought on by the lethality, precision, and range of modern weapons coupled with the timeliness and accuracy of information provided by information age systems and sensors. The ability to make and communicate decisions faster than the enemy remains the means to create a tempo of operations to which the enemy cannot react.

Young soldiers will be placed in positions of greater responsibility with less close supervision than before. They and the junior leaders over them will be counted on to act quickly and decisively under great stress.

Leaders will have more decision relevant information on hand to consider and less time to consider it. They will need to become comfortable with new tools for providing direction and maintaining control while maintaining the traditional skills for providing purpose, and motivation.

The commander maintains a current estimate, receives recommendations and passes judgment on the utility and viability of the options he is given. This will not change. The most challenging task for staff planners will continue to be to monitor the situation, ask the right questions pertinent to the future, get those answers quickly, generate hypotheses to be tested, and create viable options. The rest is rote work. The creative parts of these tasks will be enhanced by technology and the rote work will be accomplished by machines.

Staffs working as interneted “teams of teams” sharing information -- data, guidance, analysis, and synthesis -- have the potential to greatly streamline and accelerate sound and creative planning, decision-making and control. The logic of our command and staff doctrine, built up over so many years, will not be abandoned, but the embedded principles take shape in new and more streamlined methods. Organizational arrangements do not abandon principles but adapt to the new conditions.

Finally, the tendency to employ information technologies to over centralize decisions will limit tempo, and limit the employment of the full potential of the tools soon to be in the hands of commanders. The current mission orders command philosophy, with appropriate delegation of decisions authority, will be the only way to take full advantage of future technological potential.

The art of command will face new challenges.

Victory and defeat will still turn on the determination of leaders to venture into a high stakes unknown and the willingness of soldiers to follow. The tempo of operations and greater isolation due to greater dispersion will introduce new stresses on soldiers and leaders.

Marginal differences in the quality of soldiers and leaders will be magnified in a future conflict between technological equals. As the power of each organization expands, and fewer organizations of a given level are required to achieve a certain effect, then the

impact of each soldier, each sergeant, each lieutenant, etc. becomes more significant. Each organization will also be less compact -- take up more space. This means that junior leaders and their soldiers will receive less supervision at those critical moments during battle when they must act in the face of danger. Relating by digital link may not be as comforting as knowing that team members have visual contact.

Leaders must still make difficult judgments about future uncertainties.

Information technologies will not create an environment of certainty. Decision support information technologies can help present and organize information. They can also make predictions about factors in war which are based on the laws of physics, but they are unreliable predictors of moral factors. Even if perfect information about all current friendly and enemy conditions and dispositions is known, leaders must make judgments about what will be when forces, currently moving, become engaged. Even perfect knowledge about current conditions and dispositions is insufficient to plan the tactical actions of large formations. Leaders must still make informed assumptions about future dispositions and conditions. This requires a boldness of mind and the willingness to accept responsibility for such assumptions. But, leaders can only seize and retain the initiative by planning ahead and setting the tempo and conditions of battle. Plans are always based on assumptions and uncertainties which require sound judgment.

Experience, education, training and selection will be vital to develop the necessary judgment in leaders.

It may take longer to develop the leader for his crucial role than today. Leaders must fully utilize new and potent capabilities. Adapting methods and integrating new weapons into existing combined arms combinations will become more challenging as change continues to accelerate. Leaders must also understand the meaning of information to use it effectively. This will depend on experience, education and training.

The Impact of Advanced Information Technologies.

Battle Command effectiveness will be magnified by at least an order of magnitude through advanced information technologies.

Faster Reaction

Leaders can then react faster to unforeseen circumstances and to the enemy's initiative. This is good because the enemy can be unpredictable. A combination of technological applications, automated processes, and command and staff procedures, will give the commanders and staffs of the 2020, time frame an order of magnitude better awareness of the situation at any time than commanders today. Digitized systems rapidly transmit directives and orders vertically to subordinate levels while transmitting other essential information horizontally across the organization to present a common relevant picture of the battlefield at all levels of command.

More Flexible Command Posts

The advent of the telephone caused commanders to hesitate before leaving the link to higher headquarters. In World War I it is reported that commanders lost touch with reality when their troops left the trenches for "no man's land" and they stayed in their command bunkers to be responsive to the queries of their bosses. The future commander can command from anywhere in his battle space. Commanders will continue to need to meet with subordinates face to face -- the need to insure understanding, to gage morale, and to lead -- but distances to travel, because of more dispersion, will be greater and thus the time away from the command post may also be greater. The commander and key staff will require modules which keep them in touch with the "relevant common picture" when they are away from the command post. Such command modules will be technologically feasible and very necessary.

The future forces will be able to echelon headquarters for mobility and flexibility, while maintaining communications. A proper mix of specialty knowledge and adequate manning of specialty functions for high tempo operations around the clock are important. Seamless communications will make it possible to leave supporting staffs behind in secure enclaves or at home station without losing the benefit of their support. There will be a loss of effectiveness when the staff is split. But we will need to develop ways to mitigate the disadvantages because there will be times when "split basing" will be most advantageous.

The "Relevant Common Picture"

This is the visual display and underlying data base which is shared throughout the staff and with subordinates.

The value of sharing the "relevant common picture" is sharing the information the commander uses to make decisions. This allows others to anticipate those decisions, which in turn speeds up coordination, planning and the tempo of organizational responses in general.

It is important that the "relevant common picture" be relevant. The entire staff participates in maintaining its relevance and currency. It is not left to a few staff specialists disassociated from planning, and bearing no functional responsibility. The G-staff principals remain responsible for the contents of the "relevant common picture" data base. For instance, it has been the responsibility for the G-2 to know what the commander needs to know, so he insures that a relevant intelligence summary is maintained in the data base.

What makes the "relevant common picture" relevant is its utility in decision making during the course of executing a particular course of action -- whether to continue with the current plan, or chose another branch; whether to reinforce the current main effort or shift the main effort; whether to launch the next deliberate attack as planned or delay hoping for better conditions. No generalized body of data can do that.

The "relevant common picture" is really a continuously updated staff and command estimate pertinent to current and future operations. It has long been a doctrinal requirement for the staff to maintain a continuous staff estimate. This was mostly a mental process backed up with the situation map and a set of charts which maintained the status

of certain important assets. The staff and commander's estimates combined are an assessment, a synthesis, of information pertaining to current operation (recommendations and decisions) and future operations (recommendations and decisions). This means that the shared data base and its frontal face display are a synthesis of the staff estimates about the current operation, and staff estimates pertaining to the next operation. The latter would be the "common shared planning data base."

Information Management approaches, tools and agencies are created.

The management of data bases and priorities of information movements are vested in a new staff agency supervised by the chief of staff. The control of communications "pipes", band width access, and data bases will be as important as was controlling traffic through the intersection at St. Vith during the W.W.II Battle of the Bulge. Uncontrolled movements of large bodies of digital data could block the passage of higher priority traffic. "Traffic management" approaches, tools and agencies will have to be created.

Spans of Control and Command

A streamlined, and flexible echelonment system takes advantage of technology to expand spans of control while retaining a robust span of command when special criteria are met. Information technologies easily facilitate far greater spans of control because the control function is more related to tracking information and responding to objective criteria with permissive or restrictive guidance. The command function is not as easily facilitated because the information it depends on is more nuanced and the command response to information includes difficult judgments, emotional encouragement or censure, and the transmission of moral force. These are not easily transmitted through electronic media. The future force may expands spans of control and eliminates some permanent layers of command. In current Army After Next experimental organizations the Battle Force, the Battle Unit, and the Battle Element are the three permanent echelons with six or more subordinate organizations. They replace the four echelons from division to company, each with smaller spans of control/command. This economizes staffs needed for control functions and takes advantage of information technologies which enable expanded spans of control. At the same time, these experimental organizations inject temporary echelons of concentration when a more robust span of command is required. These temporary headquarters rely on the higher parent headquarters and staff to perform the normal "control" functions for them.

Permanent Echelons of Maneuver

In the experimental organizations of the Army After Next, the battle force, the battle unit, and the battle element are all echelons of maneuver, in that they are permanent groupings assigned combined arms appropriate to each level. They all may be augmented with support from the next higher permanent echelon of maneuver when their mission demands it. There are six battle units in a battle force, and six battle elements in a battle unit. The

battle element is smaller than a company today and commands six vehicle crews or squads directly.

Whether the “rule of six” is appropriate at each echelon is currently not known. What is known is that spans of control can be greater than they are today. There is also evidence from the 1997 cycle of AAN studies to suggest that a “rule of eight” may be too much. It was difficult to fully engage all eight of the subordinate echelons in any given mission. But even this evidence should not be considered to be conclusive. It may be that tougher missions need to be assigned. Only time and experience with real people will tell what is an appropriate span of control.

The notion that the permanent echelons of future organizations should be “echelons of maneuver” rather than modular “echelons of concentration” is also easily supportable. Organizations need “doctrine” and interpersonal stability within some grouping of “building blocks”. With too much flexibility in structure comes the difficulty of having a coherent doctrine and coherent ways of relating the parts and pieces of an organization.

Echelons of maneuver are building block “organisms.” The people in this organism all “belong” and share long term interpersonal relationships. They learn to work smoothly with each other. They become teams. Teamwork among people becomes more important as the speed, danger, and impact of operations increases.

Temporary Echelons of Concentration

AAN echelons of maneuver can form temporary echelons of concentration when a more robust span of command is needed. There are no permanent echelons of concentration, such as the brigade is today, within the battle force. However, echelons of concentration will still be useful in the future when the complexity, speed and stress of an operation combine to require a higher leader to led ratio. These intervening echelons of concentration are not always required. When Battle Units and Battle Elements are rotated into and out of action sequentially, even when the tempo of operations is high, the intervening temporary headquarters may not be required. But some operations will make them absolutely vital. For instance, when all subordinate battle units or battle elements are employed simultaneously, or nearly simultaneously, into a stressful, high tempo operation, and more than one organization is assigned to one of several major tasks, then the demands of leadership, coordination and complex, rapid decision-making will demand smaller spans of command.

Combined Arms Task Groups coordinate and temporarily assume command of Battle, Fire Support, and Aviation Units. These **temporary, but standing, C2 elements are formed from within permanent TOE resources** of the Battle Force headquarters. They are commanded by deputy commanders and controlled by staff teams drawn from the staff at large. They require little in the way of staff facilities, and may operate from within the facilities of the parent staff as long as they are required. Combined Arms Task Forces are similarly formed under Battle, Fire Support, and Aviation Units when the criteria for more robust span of command is met. Element level echelons may form temporary “Teams.” Normally these temporary groupings endure only through the accomplishment of a

particular mission. They form during "mission staging," and reform at the next "mission staging".

The Battle Force may direct the formation of a Combined Arms Task Force to be subordinated directly to the Battle Force. Task forces may endure only a few days.

"Anticipatory Planning."

Setting the Terms of Battle

The most certain way to maintain a predictable planning environment, or to at least constrain unpredictability, is to seize and maintain the initiative. Thus, setting the terms of battle at the outset, and never letting the enemy recover should be the aim of every plan. Every attack must be exploited, every exploitation lead to the next attack, and so on. Logistical replenishment of one battle unit --a kind of "pit stop" logistics -- occurs under the cover of the passage of an exploiting battle unit. And it occurs when and where it is planned if the initiative is maintained. This has great implications for logistical concepts.

Anticipate and Preempt a Range of Enemy Options

Rather than a long detailed plan relating to the enemy's most likely course of action, anticipatory planning attempts to anticipate a range of enemy options and develops a set of friendly options which defeat or preempt them. Each option is simple to understand, and is conceptually outlined using both words and sketches. Options share as many features as possible to make reorientation from one to the next easier. Some options may differ only to the extent that the main effort shifts. Task and purpose type missions are assigned to each subordinate. Coordinating instructions are simple and to the point. The critical information requirements pertinent to each option are outlined. The weight of planning effort goes into analysis and synthesis leading to a continual revision of the range of options available to the commander as current reality changes. It is a dynamic and continuous process. At the lowest tactical level this process may appear to be an informal continuous improvisation a step or two ahead of the enemy. At higher levels, decision lead times are greater, more staff expertise is required, and more agencies and elements need to be coordinated.

A Plan to make, disseminate, and coordinate a sound plan in time

Anticipatory planning also differs from current approaches in the level of detail devoted to the later portions of an operation. These later phases are never executed as planned. While the mission, desired end state, and an overall concept may be expressed and outlined before the operation begins there is no attempt to assign missions, and develop even a concept for the phases more than two days away. There are too many uncertainties, and it is a waste of time.

Instead, there is a plan to make, disseminate, and coordinate a sound plan soon enough. There is a plan to gain relevant planning information, and relevant execution decision information. There is a plan and a process to coordinate, communicate and give and receive updated planning guidance. There is a plan to share planning information vertically

and horizontally among planners to insure coordinated parallel planning. Most importantly, there are good standard operation procedures and a common understanding of accepted methods (doctrine).

Information technologies enhance anticipatory planning.

The ability to share vertically and horizontally a comprehensive, fairly accurate and common view of the present situation is a great advantage. The ability to rapidly disseminate planning guidance and newly generated options for planning also is a great advantage. Of great benefit will be future applications which aid in rapidly checking the viability of options and calculating support and resource requirements, and time distance factors. Technological applications which aid in visualizing, illustrating, briefing, and rehearsing options will also be helpful. Of greatest benefit will simply be the speed with which mechanical analysis, compilation, communication and information sharing can take place. This will leave more time for synthesis, the creative process of assigning meaning to information and generating potential options.

Enemy oriented mission assignments, fewer control measures, and reduced levels of detail

To the extent that decisions about details can be delegated and coordinating instructions and control measures can be minimized and simplified the tempo of operations is enhanced.

At the higher operational levels it has always been possible to identify the enemy force to be engaged during mission assignment. By 2020 it may also be possible to do so at the lower tactical levels. As sensor suites, fusion and analysis improve, it will be possible to locate, observe, and track the enemy well before it is most advantageous to engage him. (It will also be possible to immediately assess the result of attacks and exploitations.)

It will therefore also be possible to assign missions to subordinates by referencing specific elements of the enemy array. And by doing so it will be possible to do away with terrain objective or engagement area control measures. Enemy oriented mission assignments mean reduced need for terrain oriented control measures.

Lateral boundaries will still be required to clearly designate responsibilities for terrain management and security, and so on. Boundaries and coordinating points will be easily adjusted between adjacent elements to accommodate the evolution of the situation and the actual location of the fight. New information is shared via the "relevant common picture." But the practice of assigning terrain objectives ("seize and retain objective Alpha") will be replaced by identifying a specific force in the mission statement ("attack and destroy the lead regiment on the 21st Division's eastern axis of advance.")

This reduces the level of detail required in plans and speeds execution. Detailed plans are difficult to comprehend quickly, and require a great deal of coordination time and effort. **Reorganize the staff focus from "deep, close, and rear" operations to "current" and "future" operations.** Getting away from spatially organizing the battle field to an enemy oriented coordinated battle also implies that there will be no future need for the current "deep, close, and rear" organizing framework. "Deep, close, and rear" will no longer

make sense because they will be a remnant of an older way of orienting tactical organizations. Before the introduction of the “deep battle,” all current operations were controlled at the forward tactical command post. Planning and sustainment was done at the main command post. The reason deep operations were planned and controlled at the main command post was a practical one. That was were the deep targeting information was, and the communications to coordinate them. A better future organizing framework will be current and future operations, as before the early 1980’s. All battles of the future will consist of simultaneous engagements in depth. Control cannot be divided between geographically separated locations.

Organize for smooth execution decision-making

The most valuable part of the plan may be the plan for decision making. This idea is reflected in some current “Execution Matrix” approaches. The staff prepares, and the commander revises, the plan which outlines what decisions need to be made, when they need to be made and the information which needs to be in hand to make these decisions.

Even today the key decisions during the execution of any plan should be about options which are already a part of the plan. Current staffs often cannot generate options fast enough to keep ahead of events. Future staff planners conducting “anticipatory planning” using future information technologies can continually remove options from the active list and add to them as the situation evolves. Some options are removed because the enemy situation makes them obsolete -- others because the friendly situation has changed.

Being able to share new options and an evolving decision plan (and the information leading to key decisions) will be a powerful aid to organizational effectiveness. Subordinate elements will be able to anticipate decisions about options as the information relevant to decisions is accumulated and shared. They will be able to update their options sooner and the organization as a whole operates at a higher tempo with less friction.

Mission Orders Command

A “mission orders command” philosophy places a premium on intelligent delegation of decision making authority rather than on increased centralization to achieve rapid and effective rather than slow and efficient progress.

Successful commanders will continue to delegate appropriately.

The Army’s current “Mission Orders” philosophy of command will continue. Once operations are underway, many discrete decisions are required at each level of command simultaneously to achieve the high tempo of activity required to maintain the initiative. Thus a higher commander may have the information at hand to make decisions for a subordinate level, but he chooses not to do so because this would increase the number of decisions he would have to make in a given span of time and delay the tempo of operations over all. He would rather have his subordinates make such decisions, even if they tend to be different from the ones he would make in their place. He trades quantity and speed for “quality” and a slower pace.

Three reasons for prudent delegation.

First, the brain of each decision maker can only process so much information in a given space of time. Fixation on issue number one, delays attention to issue number two, and so on.

Second, potent capabilities available for action remain idle when the leader and his staff have too many decisions to make. Sometimes they don't have time to think of creative ways to use capabilities. And other times they have the status information readily at hand but have not mentally absorbed and processed the meaning of it.

Finally, the meaning of new and unexpected information is not recognized and is, thus, not acted upon. The relevance of each new fact decays with time. A vigorous enemy insures that the "relevancy half-life" of the signatures he gives off are short. The windows of opportunity to employ subordinate formations in other than the expected ways open and close. It is only during those windows of decision that branch plans can be activated and newly emerging opportunities exploited. A belated decision causes a formation to be tied up in ineffective "marching and counter marching" or precious long range precision fires are employed ineffectively.

Better informed subordinates make better decisions.

Information technologies make possible the horizontal and vertical distribution of the "relevant common picture". This relevant common picture facilitates the "mission orders" style of command advocated by current US Army doctrine. Less explicit or "hands on" control is required when trained and motivated subordinates see the same picture as their neighbors and their bosses. Knowing the higher commander's intent for the operation, and the assumptions upon which it was based, they can act more quickly and more appropriately when the situation changes (as it will).

Better trained and educated subordinates make even better decisions.

Experienced commanders know that the competence -- the selection, training and education -- of subordinates determines their willingness and ability to delegate decision authority. The higher the competence level of subordinates the better the individual decisions of subordinates and the more effective the organization as a whole. To profit from a "mission command" approach, commanders and staff must be prepared to assume the positions they occupy. Learning on the job will always be necessary to some extent, but to the extent this can be minimized with realistic training and rigorous education the better. As the cost of equipping an organization rises, the value of training and educating the people who will employ this sophisticated gear will also rise proportionately.

Summary

The scope, intensity, and tempo of contemporary and future operations differentiates current and future battle command from timeless challenges. The lethality, precision, and range of modern weapons coupled with the timeliness and accuracy of information provided by information age systems and sensors creates new tensions and conditions. But

the ability to make and communicate decisions faster than the enemy remains the means to create a tempo of operations to which the enemy cannot react.

Senior and junior leaders will dispose of more combat power, by far, and will be counted on to act quickly and decisively under great stress. Young soldiers under their command will be placed in positions of greater responsibility than today with less close supervision than before.

Learning how to use information effectively will be key. While leaders will have more decision relevant information on hand to consider they will have less time to consider it. While they will have new tools for providing direction and maintaining control they will need an abundance of traditional skills for providing purpose, and motivation.

The human capital of future organizations will require considerable investment to deliver the full potential of capabilities which can be in the hands of soldiers and leaders at all levels. Selection, education, and training costs will represent a smaller marginal portion of the over all cost of a future high technology force. And investments in the human dimension will bear great marginal returns. The technologies applicable to training and education will change and improve as well, and harnessing them will be important to the full effectiveness of future organizations.

Staff work will change. Staffs will work as interneted "teams of teams" sharing information -- data, guidance, analysis, and synthesis. There is the potential to greatly streamline and accelerate sound and creative planning, decision-making and control. While the logic of our command and staff doctrine, built up over so many years, will not be abandoned, the embedded principles will take shape in new and more streamlined methods.

Sharing the "relevant common picture" -- the information the commander uses to make decisions -- allows others to anticipate those decisions. This speeds up coordination, planning and the tempo of organizational responses in general.

Large organizations will become more flexible as commanders and staffs understand their options and the enemy's range of options sooner. "Anticipatory planning" -- generating multi optioned plans in anticipation of a potential range of conditions -- will become a possibility as information technologies continue to evolve rapidly. This will make planning more relevant.

Organizational arrangements do not abandon principles but adapt to the new conditions. Span of control may expand and organizations will appear flatter, but because of the unique nature of military action, there will be new ways to insure that span of command is not stretched beyond the demands of the situation.

The current mission orders command philosophy will be important to optimize the full potential of future organizations in combat. The temptation to employ information technologies to centralize decisions will be ever present. But future commanders will realize that centralization will limit tempo, and limit the employment of the full potential of the tools soon to be in their hands. Appropriate delegation of decisions authority, will be the only way to take full advantage of future technological potential.

Finally, the development of the science of battle command will be increasingly important. It will complement the fuller practice of the art. Together they will realize a fuller human contribution to battle outcomes.



The Human Dimension of Combat

by

Huba Wass de Czege
BG, US Army, Retired

Perspective

- Sun Tzu (500 BC)-considered the moral, intellectual, and circumstantial elements of war more important than the physical.
- Vegetius (400 AD)-"Victory in war does not depend entirely upon numbers or mere courage; only skill and discipline will insure it."
- De Saxe (1750) "the courage of the troops must be reborn daily...It is of all the elements of war the one that is most necessary to study."
- Frederick the Great (1753) "The greatest force of the Prussian army resides in their wonderful regularity, ...in exact obedience, and in the bravery of the troops."
- Napoleon (1800) " In war, the moral is to the physical as three is to one."

More Perspective



- Karl von Clausewitz (1830) On War War has both a physical and moral dimension. While the means of war are mostly physical, battle is often decided by genius, chance, “friction”, discipline and morale.
- Ardant du Picq (1868) Battle Studies “man is the fundamental instrument in battle.” “You can reach into the well of courage only so often before the well runs dry.”
- Lord Moran (WWI) The Anatomy of Courage A book about how courage is born and how courage is sustained in a modern army of free people.
- S.L.A Marshall (WWI and Korea) Men Against Fire A study of why men fight.
- John Keegan The Face of Battle A study of human behavior at Agincourt (1415), Waterloo (1815), and the Somme (1916).

Defeat Mechanisms in War



- Defeat by attrition emphasizes the physical dimension of war: the focus is physical sources of power (Vietnam War and Desert Storm air war)
- Defeat by disintegration emphasizes the moral dimension of war: the focus is state of mind and incapacitating organizations (May 1940 defeat of France, and Desert Storm ground war)
- Historically employed in combination as the situation dictated.

Attrition Defeat Mechanisms



■ The principle:

- “Break things and hurt people”
- Physical punishment eventually eliminates the power to fight.
- Defeat results when a threshold is reached beyond which fighting is not possible.

- Defeat thresholds vary depending upon morale, discipline and leadership.

Future attrition methods

- Future airpower and long range missile forces use “precision engagement” methods to attack and re-attack vital and decisive targets until resistance ceases
- Pros: Attrition methods are simple in concept, and take advantage of “Information dominance” and long range precision stand-off weapons to destroy the enemy at arms length.
- Cons: Some conditions are not conducive to achieving decisive attrition effects, these effects may not last, and they generally require great destruction.
- Reliance on “precision engagement” may reduce risk of casualties at increased risk of mission failure

Disintegration Defeat Mechanisms

- The principle:
 - A concentrated pulse of violence creates shock and destruction.
 - Shock temporarily incapacitates people not directly touched by physical destruction
 - Temporarily incapacitated people temporarily incapacitate organizations.
 - Incapacitated organizations are vulnerable to defeat by smaller, well organized exploitation forces
- Collapse occurs catastrophically if the “pulse of violence” is immediately exploited, but people and organizations recover if the timing of the exploitation is too late.

Future Disintegration Methods

- An “ambush like” violent pulse of near simultaneous multiple “precision engagements” strikes highly selected key and vital points. The temporarily incapacitating shock and destruction is exploited by “precision maneuver” of close combat capable forces against the entire organization
- Pros: Operations which achieve disintegration effects are very rapidly decisive, cause less collateral damage because of a more controlled application of force, and benefit from modern combat multipliers like information operations, and non-lethal weapons. Casualties are usually very lopsided.
- Cons: exposes soldiers and marines to close combat and requires great skill, discipline and close coordination
- Some risk of casualties is traded for more rapidly decisive results.

In combat, both defeat mechanisms are usually at work simultaneously.

- Methods aimed at disintegration are preferred when rapid decisive results are important and vital interests are at stake.
- Methods of attrition are preferred when limiting casualties is most important, vital interests are not at stake, and time and collateral damage is not an issue.

Attrition methods are more easily modeled in simulations



- The physical domain is most easily reduced to equations. (Lethality, precision, timing, information, speed, ranges, protection and supply.)
- The moral domain is more difficult. (Fear, fatigue, judgment, motivation, cohesion, discipline, perseverance, surprise, and leadership.)

What is Combat Power ?

- Contending commanders bring capabilities to bear to produce a relative superiority in combat power.
- First order components of Combat Power
 - Leadership effects
 - Maneuver effects
 - Fire Power Effects
 - Protection Effects

Leadership Effects

- Leaders convert potential into power
- They focus the energies of the organization toward a purpose by defining goals, missions, and goal
- They provide direction by means of a plan, a method, coordination, setting standards of performance, and establishing values and habits.
- They motivate soldiers to perform difficult tasks in trying circumstances. What counts is not present for duty strength but the number of soldiers actively engaged in fighting.
- They sustain the performance of the unit over time. They train soldiers, develop junior leaders, manage resources, maintain discipline and morale, and anticipate requirements.

Maneuver effects

- Achieving a relative position of advantage
- Depends on physical mobility, speed, and terrain
- Also depends on analytical skills, navigation, endurance, etc

Firepower Effects

- This is actual or threatened incapacitation or destruction
- Depends upon lethality of munitions, volume of fires, accuracy of weapons, and quality and quantity of target information
- Also depends on skill, judgment, alertness, etc. of soldiers

Protection effects

- This comprises everything done to conserve the fighting potential of the force.
- This includes both physical and psychological factors to avoid detection, complicate the enemy's ability to engage, and minimize damage when engaged.
- It also includes maintaining health and overcoming the effects of the environment.

Combat Input Functions

- Command, Control, and Communications
- Maneuver
- Fires
- Intelligence
- Mobility, Counter Mobility, and Survivability
- Air Defense
- NBC Defense

Combat Output Functions

- Finding and tracking the enemy throughout the operation
- Keeping the enemy from finding and tracking you until too late
- Maneuvering the main effort against the decisive point.
- Exploiting the success of the main effort.
- Follow through to the next operation.
- Fixing: Preventing interference

The importance of the human dimension in the future?



- As military hardware becomes more complex and costly it will become increasingly important that soldiers be capable of exploiting its full potential.
- More power in the hands of fewer people in smaller organizations increases the importance of each individual's contribution and the effectiveness of the organization.
- Understanding the human dimension of combat will be important as long as war remains a contest of wills and a test of human capacity to perform under adversity.
- Future combat is likely to be intense, deadly, personal, decentralized, and dispersed.

Cognitively Engineering Technology for the Army After Next

Leonard Adelman
Dept. of Operations Research
and the C3I Center of Excellence
George Mason University
Fairfax, VA 22030

Abstract

Cognitive engineering (also called cognitive systems engineering) bases system design on cognitive research findings regarding how people think. Its goal is to have human cognitive processing requirements, not information technology, drive system design, particularly of the human-machine interface. This orientation is critically important as we transition from information dominance to knowledge dominance. Military systems need to be designed to permit operators, including commanders and their staff, to see and act faster and smarter because the knowledge implications of the information is readily apparent.

Although still in its infancy, a cognitive engineering approach has been applied successfully to the redesign of military systems. These include, for example, reengineering system interfaces for the AWACS Weapon Director (Klinger et al., 1993), the submarine approach officer performing anti-submarine warfare (Gerhardt-Powals, et al. 1995), and USAF tanker operations officers (Ehrhart, 1994). In the last two cases, the cognitive engineered interface led to better operator performance than the “new” interfaces being proposed by the system developers who were actually building system upgrades. Taking a cognitive focus results in clear, measurable performance improvements.

Cognitive engineering initiatives are currently underway in all the armed services to ensure that future systems are designed to support and enhance human cognitive functioning. For example, the Army Research Institute (ARI) and Army Research Laboratory (ARL) are leading a Cognitive Engineering Science and Technology Objective (STO) for the U.S. Army. Although this and other initiatives will certainly have a positive impact, the long-term effect of cognitive engineering for the Army After Next (AAN) will still depend on resolving basic and applied research issues. This paper addresses some of the issues in three areas: (1) cognitive theory and research, (2) cognitive design frameworks and methods, and (3) technology assessment.

Introduction

"Even armed with the advantages of sophisticated information aids, AAN leaders may find their decision-making capacities quickly overwhelmed" (AAN Report, 1997, p. 22). The basis for this concern is the anticipated features of the AAN combat environment of 2025:

- * extremely high operational tempo;
- * compressed planning and operations cycles;
- * decentralized operations throughout the battlespace;
- * stress, both physical and mental;
- * a larger, more lethal battlespace; and
- * asymmetric enemy responses directed at increasing ambiguity or complexity, and thus the time Blue needs to control the situation.

These are the environmental features (or environmental requirements assumptions) against which future combat systems must be designed. These features require a cognitive engineering approach to system design. They require that operators be able to immediately see the knowledge implications of the information they receive and, thereby, effectively act faster than the enemy can respond.

"... the 2025 battle force will protect itself primarily through knowledge and speed" (AAN Report, 1997, p. 25). Technology will be the primary means to achieving this end. AAN planners see technology as the means to transition from the information dominance of our current military force to the knowledge dominance required by our force to deal with the environment of 2025. But a pure technology push will not be enough. We also will need a cognitive requirements pull to ensure that technology is designed so that operators can immediately see what all the data means.

The technology envisioned for knowledge dominance will require a robust, redundant, and flexible network of communications for gathering information, and systems for translating that information into knowledge. The goals of the digital Army, which are a mighty leap forward, will not be enough. It will not be enough to simply know where Red forces are on the battlefield, we will need to recognize enemy intentions and understand their pattern of operations, task organization, phasing, and tempo rapidly enough to support fast and effective Blue maneuver before Red can respond. "Human engineering/cognitive engineering" is one means toward accomplishing that goal. It's on the "AAN Technology Short List" (AAN Report, 1997, p. 25).

Although indispensable, advanced technology is not enough. AAN planners assume three other characteristics along the "human dimension" for success. These keys will become additional requirements assumptions against which systems must be designed. Consequently, they are considered briefly, in turn.

First, AAN planners assume highly experienced, mature leaders. Leaders with a mastery of increased skill sets, greater experience in command positions and staffs, and a firm foundation from which to exercise battlefield intuition. Second, AAN planners assume highly cohesive military units that have trained together for longer periods than current units. It is assumed that soldiers in such units will have shared views of the battlefield and, therefore, little need for communication. Recent research with Patriot air defense operators suggests that this assumption is scenario dependent; change the type of scenario and soldiers' may no longer share common views of the battlefield (Adelman, et al., 1996). Therefore, the third AAN assumption is particularly important: train soldiers in conditions nearly indistinguishable from actual combat.

These assumptions, highly experienced officers leading highly cohesive units that have trained in conditions nearly indistinguishable from actual combat, represent critical cognitive engineering requirements for combat systems. Systems are not designed for just anyone who may be tasked to use them, unless that is the overriding requirement. Rather, systems are designed based on one's assumptions about the type of operator, organizational unit, training, and environment within which they will be used. These requirement assumptions are critically important to the success of a cognitive engineering effort, and require elaboration throughout the AAN planning process.

Cognitive engineering emphasizes the operators' knowledge, cognitive, and performance requirements. This emphasis is not meant to downplay the importance of functional and nonfunctional system requirements. Cognitive engineering is, first and foremost, requirements driven, system engineering. Rather, cognitive engineering emphasizes the human, cognitive component of the system. Assumptions about the (1) operators' experience and training (and therefore, knowledge), (2) the other soldiers in the unit (shared views and need for minimal communication), and the (3) environmental conditions under which the soldier will use the system will have a critical impact on the system's design. If these assumptions are inaccurately or inadequately defined, then the system will not meet the cognitive requirements of its users. Therefore, accurately defining the cognitive requirements for AAN technology will be essential to developing cognitively engineered, combat systems that fulfill AAN planners' vision.

Although still in its infancy, a cognitive engineering approach has been applied successfully to the redesign of military systems, as noted in the abstract, and elsewhere, such as in nuclear process control (e.g., Vicente et al., 1996). Cognitive engineering initiatives have been supported by NATO (e.g., Essens et al., 1995), and are currently underway in all the armed services to ensure that future systems are designed to support and enhance human cognitive functioning. For example, the Army Research Institute (ARI) and Army Research Laboratory (ARL) are leading a Cognitive Engineering Science and Technology Objective (STO) for the U.S. Army. Although this and other initiatives will certainly have a positive impact, the long-term effect of cognitive engineering for the Army After Next will still depend on resolving basic and applied research issues in different areas.

Research Areas

This paper addresses issues in three research areas: (1) cognitive theory integration and research (i.e., how people think); (2) cognitive design frameworks and methods (i.e., how to externalize thought); and (3) technology assessment (i.e., how to best support thinking). Each area is considered briefly, in turn.

Theory Integration and Research

Theory is one's way of integrating research findings. Cognitive theory, and the larger body of cognitive research findings and knowledge it encompasses, guides one's cognitive engineering approach. However, we do not have one cognitive theory. Rather, we have a different theories based on different research foci.

There are, for example, different cognitive theories to explain problem solving (e.g., Ericsson & Smith, 1991), situation assessment (e.g., Adams et al., 1995), human judgment (e.g., Hammond, 1996), and decision making (e.g., Klein et al., 1993). Sometimes these theories are synthesized, but often researchers in one field don't even know about the research in another. Nor is the cognitively-oriented research in traditional human factors (e.g., Wickens, 1992) integrated into the above areas. Even within a particular area, there is a plethora of theories. For example, nine different theories of "naturalistic decision making" are represented in Klein et al.'s edited volume. That does not include research on decision heuristics (and biases) emphasized elsewhere (e.g., Bazerman, 1994).

Many people might be surprised and appalled by this state of affairs. I am not surprised for three reasons. First, the field of cognitive research is quite young. Major papers, like Nobel Prize winner Herbert Simon's (1955) attack on economic-based, "rational man" models of decision making, are less than 50 years

old. Second, there is much to learn. Think about all the different contexts, both in the laboratory and various applied settings, where we try to understand how people think through complex problems. Given research specialization, it's not surprising that different research groups have developed different research methods that they perceived as appropriate to their problems. And, third, cognition is context dependent. It is affected by different combinations of environmental features, and by the knowledge a person brings to the situation. Again, given research specialization, it's perhaps not too surprising that different theories have developed to explain the research findings in their particular contexts.

I am not appalled by this state of affairs. Science is an evolutionary, and some like Kuhn (1962) might say "revolutionary," enterprise. Our understanding of human cognition is substantially advanced over what it was just 10 to 20 years ago, and we have already been able to use that knowledge to build better systems. Moreover, there are increasing efforts to begin integrating the different context dependent, cognitive theories, as efforts by Hammond (1996), Klein (1997), and Lipshitz & Strauss (1997) illustrate.

We need continued efforts toward theory integration and enhancement, as well as performing the research to increase our knowledge of human cognition. Put simply, *we need to know more about how people think*. Both theory and research need to develop schemes for classifying environmental, human, organizational, and technological features of the situation. By doing so, we will be better able to understand context dependencies in different settings and, thereby, generalize across them. This will result in a broader, more sophisticated set of cognitive principles against which to design future technology.

We also need additional research. In particular, we need to perform research representing the requirements assumptions envisioned by AAN planners for 2025 if we are going to generate research findings relevant to that context. One can learn only so much by interviewing experienced personnel or by performing laboratory research with university students. One needs to be able to perform controlled research to understand how specific context dependencies affect soldiers' cognition. Such research is possible using military "man-in-the-loop" simulation capabilities. For example, I have been able to use the Patriot simulator at Ft. Bliss (Adelman et al., in press) to understand the decision making process of Army air defense operators for ambiguous combat situations. Research capabilities will be improved further with the advent of training environments representing actual combat conditions. The understanding we gain in such environments can be encoded in computer simulations to represent human cognition. Such encoding can enhance our ability to predict the effects of future systems, as well design them.

Design Frameworks and Methods

Cognitive engineering is requirements-driven, system engineering. As discussed in the introduction, cognitive engineering emphasizes knowledge, cognitive, and performance requirements. Knowledge requirements define what the operator knows and, perhaps, what the system needs to know. Cognitive requirements define how effectively operators have to be able to process information and knowledge to perform their tasks under anticipated environmental conditions. Performance requirements not only define how well these tasks need to be accomplished, but the larger organizational goals that need to be achieved. Performance effectiveness is the purposeful end result of system development.

Although successful, cognitive engineering is routinely implemented by cognitive science researchers, not systems engineers. To have a truly significant impact on future combat systems, it's the development engineers who have to be able to implement a cognitive engineering approach effectively and routinely. To accomplish this, we need to perform research assessing and improving cognitive engineering design frameworks and task analysis methods. *We need validated methods for externalizing operators' cognitive processes that engineers can use effectively and easily.*

Currently, there is no universally accepted cognitive engineering design framework. The COADE (COgnitive Analysis Design and Evaluation) framework developed by a NATO research study group (Essens et al., 1995) is probably the most well known. It is represented pictorially in Figure 1. It emphasizes analyzing performance, cognitive, and knowledge (although not shown in the figure) requirements, designing to these requirements, and constant evaluation throughout the design and development process. This orientation can be found in other cognitive engineering design frameworks too (e.g., Andriole & Adelman, 1995; Ehrhart, 1994; Rasmussen et al., 1994), but the emphasis and implementation methods are different. In addition, there are unanswered questions about the relative effectiveness, costs, and time required to implement these different frameworks. These questions can probably only be answered by systematic documentation of the results of different cognitive engineering efforts, which is a slow process. But these questions need to be answered if we are going have system engineers, not cognitive science researchers, doing cognitive engineering.

Similarly, we need to be able to tell systems engineers what cognitive task analysis methods to use. The COADE report, for example, lists over 40 cognitive task analysis methods. We obviously can't tell systems engineers, "Here's 40 methods. You pick the ones you like." We need to perform research on the relative

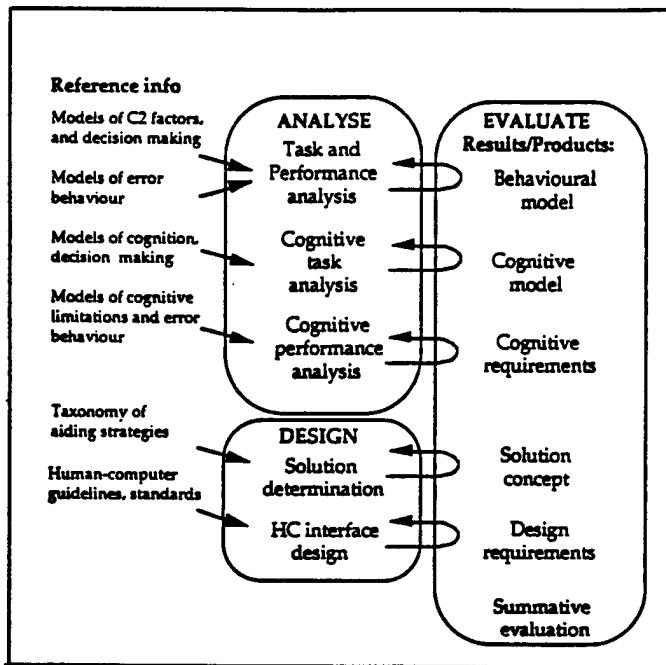


Figure 1. COADE Design Framework

effectiveness of these methods at uncovering different types of knowledge, cognitive, and performance requirements. In addition, we will have to perform research to assess how easily, quickly, and effectively systems engineers can use the methods. Toward that end, the Navy recently hosted a conference on cognitive task analysis methods. Although an important first step, there is much to be done before we have validated cognitive design frameworks and task analysis methods to hand-off to systems engineers.

Technology Assessment

Just because we take a cognitive engineering focus doesn't mean that we always know how to design systems to support it. Sometimes the problem is that the technology is relatively new (e.g., virtual reality or neural networks); consequently, substantial technological research is required before it will be ready for future combat systems. In other cases, however, we just don't know how to best tailor technological or display features to support operators' cognitive processes.

Research is needed to assess how to best support human cognition. I am taking a requirements focus, not a technological one, when making this statement. For

example, we don't know the best ways to portray situation ambiguity to support situation assessment, or operational risk to support decision making. Similarly, we don't know the best ways to support battlefield visualization. For example, although we do know that perceptually enhancing displays enhances dynamic decision making (Kirlick et al., 1996; Klinger et al., 1993), we also know that fully three-dimensional displays are not always more effective than other perceptual enhancement methods (e.g., Gerhardt-Powals et al., 1995). Nor do we know the best ways to support mental simulation and subsequent option generation or to support the integration of intuition with analysis. Research suggests, however, that analytical results that are packaged in a manner consistent with the more intuitive ways that operators explain battlefield actions have a higher probability of being accepted by them (e.g., Adelman et al., in press (b)).

Consequently, we need to perform research to better understand how to design system displays and technology to support cognitive processes. This does not mean that development has to wait until our research is completed. That approach is neither practical nor advantageous. Rather, it means that we have to adopt alternative strategies to technology assessment. Two are proposed here.

The first strategy is prototyping and evaluation. This approach is being more routinely adopted by system developers. It emphasizes requirements analysis, the development of prototypes, and the evaluation of those prototypes against one's requirements (Adelman & Riedel, 1997; Andriole, 1996). This is a highly iterative process. Therefore, depending on the problem domain, it may be relatively easy and inexpensive to design and evaluate different "throwaway prototypes" representing alternative system features. The ones that perform best against the operators' cognitive and performance requirements become the evolutionary prototypes upon which to build the system development effort.

The second strategy is to perform research assessing the effectiveness of different system features using Army personnel and "man-in-the-loop" simulators. Such settings can be arranged to represent the requirements assumptions envisioned in combat and, thus, provide critical training environments. In addition, such settings are ideal sites to conduct research to (1) understand how they affect cognitive processes, and (2) assess the effectiveness of technology designed to support them.

This strategy has been used successfully in cognitive engineering efforts using both high fidelity simulation facilities (e.g., Klinger et al., 1993) and low fidelity ones (e.g., Ehrhart, 1994). In both cases, we have been able to obtain objective measures demonstrating performance improvements and suggestions for further improvements. Since these simulations represent the requirements assumptions of

the combat environments better than other research settings, the results have a high probability of generalizing to the battlefield. From a long-term perspective, such research is a cost-effective way to perform system development.

Conclusion

Cognitive engineering is critical to designing future technology to support Army After Next requirements for knowledge dominance and maneuver speed. Cognitive engineering emphasizes knowledge, cognitive processing, and performance requirements within a systems engineering approach. That is why requirement assumptions are critically important to the success of a cognitive engineering effort, and require elaboration throughout the AAN planning process. Although initial cognitive systems engineering efforts have been successful, and ongoing initiatives extremely promising, there is still a lot to learn. This paper has discuss research issues within three areas. The first area was theory integration and future research. The focus here was on learning more about how people think. The second area was design frameworks and task analysis methods. The focus here was on better engineering methods for externalizing those thought processes. And the third area was on technology assessment; that is, developing validated technology for supporting thought. The result of research addressing these issues will be soldier-oriented systems that meets the Army's needs.

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Small Group Leadership for Elite Units

LTC John Galland
US Army Special Operations Command
Fort Bragg, NC

Dr. Mike Sanders
Army Research Institute
Fort Bragg, NC

1. Background, Selection Procedures, and General Philosophy:

The following describes the approach taken in Special Operations Forces units to develop leaders. Leader Development applies to all ranks and should not be construed to mean just Officer Development. Developmental training and experience is planned for and provided to all SOF soldiers. The type of training, exposure, and experience given to individuals is consistent with their rank and position and is designed to prepare them for future positions and duty requirements.

A general mindset has been established that promotes individual self-assessment, feedback, and personal growth. More will be said about cultivating accurate and independent personal feedback systems later.

The genesis of the Leader Development concept is found in the initial Assessment and Selection (A&S) program and the work that was done to establish that program. The attributes, identified early on as being required for all SOF soldiers, establish the foundation for future actions. The following provides a short listing of the critical attributes addressed during A&S: trainability, military and personal adjustment, stress resistance, situational awareness, complex discrimination and decision-making when fatigued tolerance for ambiguity, and flexibility.

The A&S process utilizes performance tests that reproduce the essential elements of the future job; for example, candidates are required to independently perform very physically demanding land navigation tasks, without performance feedback. The A&S process also systematically obtains other data about all applicants.

The attributes listed above are also many of the attributes required to be an effective leader, so the soldiers selected have the building blocks necessary for future development.

It should also be noted that additional requirements are placed on Officers in the A&S Course. The Officer screening program also addresses attributes that are required of effective leaders; e.g., management of high workload with conflicting situational demands, unexpected events, cognitive flexibility, leadership challenges when fatigued, interpersonal skills, and the ability to maintain the big picture mission focus while being forced to attend to detail elements.

2. Fundamental Training Principles and Command Climate:

FM 25-100 **Train the Force** provides the basic Principles of Training used at the unit, which are:

- (1) (U) Train as Combined Arms and Services Team
- (2) (U) Train as you Fight
- (3) (U) Use Appropriate Doctrine
- (4) (U) Use Performance Oriented Training
- (5) (U) Train to Challenge
- (6) (U) Train to Sustain Proficiency
- (7) (U) Train using Multiechelon Techniques
- (8) (U) Train to Maintain
- (9) (U) Make Commanders the Primary Trainers

Our challenge is to provide a sufficient breadth of training so that Leaders are prepared for the full range of types of Mission Operations they may be asked to perform and yet have time to maintain the very high proficiency levels required on critical and fundamental tasks, such as marksmanship, that are performed on many of the operations. The consequences of even marginal performance are not acceptable in the operations that we are asked to perform.

Many of the tasks we ask our Leaders to perform involve higher order cognitive processing such as rapid information processing, rapid option analysis, and decision making. The cognitive nature of these tasks makes them more susceptible to degradation due to stress and fatigue. Task overlearning is one of the most effective techniques we use to prepare for these known degradations and offset their effects.

Another technique we use to prepare our Leaders incorporates two of the above Principles of Training--“Train as you Fight” and “Use Performance Oriented Training.” These two principles produce conditions for us that are realistic and demanding. Our exercises are often high fidelity simulations of future probable operations. We make every attempt to create in our training the stress, fatigue, and uncertainty that has been described as the “Fog of War” that typically accompanies combat operations. The Officers who successfully meet the requirements imposed in A&S, have demonstrated that they can adequately adjust and perform in ambiguous high workload situations. Officers are selected for subsequent assignments based on performance in either realistic exercises or actual operations.

NCOs are selected during the A&S process to be able to continue to process information and make good decisions while very fatigued and operating in a minimum feedback environment. NCOs are given a great deal of training on the fundamentals of task operations and learn to be good team members while also learning to understand and contribute to the mission. Potential NCO Leaders are also identified in exercises and operations; through their performance, individuals are identified as having the talents, skills, and interests consistent with the performance requirements at the next level.

The longevity typically associated with SOF operators supports this process of progressive assignment of the fittest. As well, the command climate fosters a working environment that allows the best leaders to be placed in positions of greater responsibility instead of the approach, used in some organizations, which forces the highest ranking individual into the leadership positions.

Another positive element produced by this environment is the overlap between individuals in an assignment and the mentoring provided by the incumbent to his replacement. This mentoring process is an outstanding feature that promotes continuity of effective procedures and produces less fall-off in unit performance than is typically seen with personnel turnover in other organizations. SOF also takes advantage of soldier longevity by promoting discussions among individuals who have held the same or similar positions so that lessons learned are passed on to the latest position holder.

Also, briefings covering major past operations are given at NCO and Officer Development and Training Programs. These briefings are candid and take the audience back to the stressors, challenges, and mindset prevailing at the time of the operation. This vicarious learning process minimizes the chance of the mistakes being repeated in subsequent operations and maximizes the chance of successful techniques being continued.

3. Developmental Assignments and Feedback:

Practices have been institutionalized that are designed to ensure that senior NCOs and Officers are given assignments that ensure they have experience in all facets of operation. The variation in assignment also provides the Officer with different leadership demands, challenges, and corresponding personal growth.

The NCO slating process was designed to provide progressive, diverse assignments and developmental experiences for individuals while also meeting the needs of the unit. Though briefly discussed here, the decision elements used by the NCO slating board are the guiding principles for personal operation within the unit. That is, NCOs are selected for critical leadership positions based not only on their leadership, technical, and interpersonal skills but more importantly on their ethical, moral, and legal deportment. The leaders that are selected have demonstrated, on a daily basis, a commitment to high ethical, moral, and legal standards. The selection of personnel based on these guidelines accomplishes two major objectives: (1) The leaders selected are role models that demonstrate and support the desired behaviors (2) All those in the system observe the qualities that are being reinforced within SOF. The slating process includes candid conversations about NCOs' potential and capability and long term needs

of the unit. SOF also supports and encourages NCOs and Officers to take assignments in parts of the Army; these assignments contribute to the needs of the Army and provide broadening developmental experiences for the soldiers.

A key element in the Leader Development process within SOF is the counseling and feedback that all soldiers receive on their duty performance. Beginning in early phases of training, all soldiers are frequently given candid feedback on their performance. Different instructors provide this feedback at each phase of training. The NCOs that are chosen to perform as instructors demonstrate a high level of technical expertise within an area of operation and are held in high regard within the unit. The new soldiers' early interactions with the instructors, along with the feedback and counseling they provide, establish an initial culturalization and orientation.

New soldier counseling continues after initial training and is provided on a regular basis (e.g. NCOER counseling) and is based on duty performance. These sessions also include long term planning and extension counseling.

Another element of the command climate, which positively influences leader development, is the strong and consistent use of the Chain of Command. Higher-ranking individuals do not intervene and provide direct corrective directions to lower ranking soldiers, unless there is a safety violation. Instead, the need for corrective action is placed on the Team Leader/NCO to execute. This process encourages the leaders at the lowest level to develop and exercise leadership techniques.

4. Formal Training:

The Troop Leader Course is a 9-day course established for new Officers and new Sergeants Major. The course is designed to provide a great deal of information about the responsibilities and missions of different organizations and their linkage to SOF. Course participants travel to agencies such as the USASOC and JSOC and are exposed to operating procedures and key personnel that will be points of contact in future operations. The course provides these leaders with a head start in the technical understanding of linkages and capabilities of organizations that support common operations. Time is allocated during the course for problem solving exercises in which class members are invited to share their experiences and insights into previous problem resolution. Classes are also given on leadership and traits associated with successful and unsuccessful leaders. The training allows the new Leaders to reflect on their operating styles, strengths, and weaknesses relative to successful leaders.

5. Systematic Improvements in Programs:

Support also exists within SOF, as a part of the general operating climate, to investigate alternative techniques and options for Leader Development. Unit personnel are encouraged to explore innovative techniques from other fields such as Management and Sports Psychology. In recent years, we have incorporated the Kolbe and The Attentional and Interpersonal Style

Inventory (TAIS) into our training programs. The Kolbe (from the Management field) addresses team building and provides feedback to operator candidates on team related operating styles while the TAIS (from Sports Psychology) provides feedback on operating styles related to performance oriented attention and focus.

We have also incorporated the Benchmarks 360-degree feedback system (developed by the Center for Creative Leadership) for new soldiers. This Benchmarks system provides individuals with feedback from four perspectives: self, peer, subordinate, and supervisor. These kinds of tools provide a strong basis for providing feedback to leaders on how they are viewed by others as compared to how they view themselves. This kind of feedback, for a reflective leader, will provide a foundation for the development of an accurate personal feedback system.

Always of concern in selecting leaders, developing and promoting leaders, is what dimensions are critical and therefore should be assessed or the subject of feedback and developmental emphasis. Earlier in this paper some of these characteristics were addressed; recent research in related areas also point to the characteristics that are considered critical. Recent work by Zazanis (1997) with Special Forces Qualification Course cadre resulted in six dimensions being identified as the dimensions to be used in Peer Ratings in the Qualification Course. The dimensions were identified as dimensions important for success in a Special Forces A Team, i.e. important for successful field performance.

Physical Performance [Strength, Endurance; Coordination; Ability to function with little sleep; Operation under stress]

Effort and Persistence [Keeps going when things get tough; Works hard even when cadre are not around; Is always determined to succeed; Uses feedback to improve]

Social Interactions [Able to resolve conflicts and defuse difficult situations; Can read people and social situations; Knows when to back off or be aggressive, when to be serious and funny; Interacts well with people with different backgrounds]

Teamwork [Contribution to the team effort; Loyalty to the team; Trustworthy]

Leadership Performance [Planning patrols, issuing OPORDS, Isolation planning; Directing, controlling, supervising team members, Focusing unit on task at hand; Coordinating unit actions]

Tactical Performance [Battle Drills; Land navigation, reconnaissance, combat tracking patrols; Use of M60, AT4, claymores; Infiltration; Air Ops; Link Ops; Instructional techniques]

In summary, developing leaders in SOF units is not a secondary concern that is given only lip service. The attention devoted to leader development reflects the desire to have the very best personnel available and prepared for the call to action.

Cohesion in a Smaller, More Diverse Military

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By

Laura L. Miller

UCLA Department of Sociology
264 Haines Hall Box 951551
Los Angeles, CA 90095-1551

Phone: (310) 825-3059
Fax: (310) 206-9838
Email: llmiller@ucla.edu

Edward Shils and Morris Janowitz wrote a classic article to describe "cohesion and disintegration" in the German Army of World War II. In time, cohesion began to supplant morale as the operative term to explain combat effectiveness. Today, military leaders ask how they can create cohesion in military units to maximize military performance.

Homogeneity among troops has been thought essential to cohesion, and diversity has often been posited as its biggest threat. Decades of social science research on cohesion have contradicted this assumption, however, and have demanded that the question be modified. For the Army After Next, leaders will need to ask how they can foster the right kind of unit cohesion to maximize combat effectiveness, yet deter the kind of cohesion that might subvert organizational goals. Downsizing, budget cuts, the increasingly occupational character of the military, and changes in the types of people making up today's Army presented challenges to cohesion that leaders will need to address now to manage effectively in the future.

Given the common misperception that an unit can never have too much cohesion, this paper will first distinguish a positive form of cohesion from one that

can have a negative effect. This discussion will demonstrate why monitoring for negative cohesion is a new task that the military should undertake. Second, current and future challenges to positive cohesion will be outlined. Finally this paper will offer some modest suggestions on how military leaders might go about fostering the right kind of cohesion while discouraging the detrimental kind. This paper cannot provide all the solutions to coping with the new challenges: clearly additional work in this field is needed.

Social Cohesion vs. Task Cohesion

Decades of social science research on cohesion have resulted in a distinction between two types of cohesion:

Social cohesion refers to the nature and quality of the emotional bonds of friendship, liking, caring, and closeness among group members. A group is socially cohesive to the extent that its members like each other, prefer to spend their social time together, enjoy each other's company, and feel emotionally close to one another.

Task cohesion refers to the shared commitment among members to achieving a goal that requires the collective efforts of the group. A group with high task cohesion is composed of members who share a common goal and who are motivated to coordinate their efforts as a team to achieve their goal. (MacCoun 1993, p. 291)

Since the goal of fostering cohesion in military units is combat effectiveness, military leaders should be aware that task cohesion is more relevant than social cohesion:

Task cohesion has a modest but reliable influence on performance; social cohesion does not have an independent effect after controlling for task cohesion. Under some conditions, high social cohesion is actually detrimental to unit performance; moderate social cohesion appears most beneficial. Research indicates that it is not necessary to like someone to work with them, so long as members share a commitment to the group's objective. (MacCoun 1993, p. 330)

What this means is that regardless of the social composition of the unit, commitment to the group's goals is the key to a unit's success. As units successfully meet challenges, they develop greater task cohesion and are motivated to continue their record of accomplishment. In units where the

members bond primarily because they are similar to one another socially, leaders must be concerned about the potential negative effects on unit performance.

A recent Rand study examined the impact of gender integration on some units that, until recently, had been closed to women. The report found that when people thought they performed well as a unit, they rated cohesion as high or medium. Those who rated cohesion as medium tended to say that people in the unit were not a homogenous social group, but that they were able to pull together when the job demanded it. When social cohesion was perceived as low, but coupled with medium or high task cohesion, overall cohesion was rated as medium. Only when both social and task cohesion were low did people rate overall cohesion as low. The negative effects of too much social bonding were mentioned as well. In discussions over the loss of all-male bonding environments, even those who longed for the "good old days" of high social cohesion admitted that some now-abandoned types of social bonding between men were actually unprofessional and detracted from the work environment. (Getting drunk and getting into fist fights with one another are examples.)

Social Cohesion

A moderate level of social cohesion has been most effective for small group performance. Obviously, people who hate and distrust each other will have a difficult time working together as a team. Having a similar social background can be a benefit in that it can make it easier for people to establish initial connections that can lead to bonding on a superficial level. Less often considered, however, are the detrimental effects of "too much bonding." A few examples to illustrate are:

1. Social Life Interferes With Work. When the work atmosphere becomes "clubby," people may start to value their social relationships over the work at

hand. Therefore they may focus on socializing with one another -- to the neglect of their duties. Quality and productivity may suffer as professional standards slide. Parties, dating, and social events can break down the power relations necessary to get the work done. Leaders who become "pals" with their subordinates may have trouble exercising their authority when necessary. Chatting or flirting at work may slow down productivity levels. Dating or cliques may be a form of close bonding within the unit, but they tend to undermine the unit's ability to work together as a whole. As a consequence, although the primary group may offer a social identity, it can become counterproductive when that sociality takes precedence over the job. This means that people who care about each other and are willing to fight together in combat may not develop the skills to do so effectively.

2. Groupthink. This term introduced by Irving Janis in 1972 is a persistent problem of small, cohesive units, particularly when the level of social cohesion is high. When faced with making decisions, the group may not consider all alternatives and come to an early conclusion that turns out to be dead wrong. They do so because of their desire to avoid conflict and preserve a friendly atmosphere. Members become so comfortable with the notion that they are "alike" that no one wants break this illusion by introducing a deviant opinion. The group may stick with their decision even when confronted with evidence that they were wrong. Janis examined some major foreign policy decision-making groups, and found that despite all the information available to them and the expertise of group members, terrible misjudgements were made due to groupthink. The resulting fiascoes include: the refusal to acknowledge the warning signals of Pearl Harbor, the attempt to occupy North Korea in 1950, the Bay of Pigs, and the escalation of the Vietnam War. Clearly, if such learned and prominent men are susceptible to groupthink, so are soldiers and military leaders.

3. Hyperinvestment in the primary group. Donna Winslow has identified the problem of *hyperinvestment* in the small unit over the larger organization. Small groups with high levels of social cohesion may come to think of themselves as superior to the larger organization, or exempt from some of its rules. This image is popular in television and movie portrayals of the military: "rogue units" and "black sheep" are presented as successful precisely because they violate military conventions or law. Insubordination, however, is not the kind of behavior the Army will want on the highly coordinated battlefield of the future. Furthermore, Winslow found this characteristic was in part responsible for the atrocities committed by a Canadian unit serving in Somalia.

4. Atrocities. Janis related that groups which highly value in-group members are often hard-hearted toward people outside that group. They easily develop stereotypes about the "other", which may lead them to underestimate the abilities of an enemy, or dehumanize and commit atrocities even against civilians. Where groupthink prevails, members believe in the inherent morality of their group, and are unlikely to raise ethical questions about their own behavior. They are also likely to participate in a cover-up, and to lie even to their superiors within the organization. Clearly, the U.S. Army will want to minimize the odds that this type of behavior will occur.

When most people think of cohesion, social cohesion is usually what they have in mind. Many are uninformed of the possible drawbacks of too much of this kind of bonding, and unaware that a different kind of cohesion, task cohesion, is what really makes a difference in unit performance.

Task Cohesion

Task cohesion does not depend on social cohesion, and is the kind of cohesion military leaders will need to focus on developing. People from very diverse backgrounds and ideologies can be task cohesive if their job requires

teamwork and they are all committed to reaching the same goals. This type of cohesion appears to be self-reinforcing. When a group meets certain challenges by working together, they become more confident and cohesive and work together well on subsequent problems. Task cohesion can create a form of social cohesion that does not depend on people being homogenous in backgrounds, values, or opinions. People can begin to like each other because they have worked together through difficult situations in which they supported and relied on one another.

Field deployments and recent peacekeeping operations have helped with task cohesion. Units are put to the test in the field and come out knowing they can depend on one another to carry out complex tasks under stressful conditions. Other conflicts that might exist along social lines can virtually disappear when the group is working full-time on its mission and is faced with an external threat or an austere environment. For example, when I visited soldiers in the early stages of the operations in Somalia, gender conflict was, for the most part, absent, and a number of people reported that men and women got along better than they had at their home base.

Small unit cohesion is enhanced by deployments, but larger unit cohesion may suffer when only part of unit is deployed. There may be jealousy between "those who get to go" and "those who get to stay," and the behind the scenes work of the unit "back home" may go unnoticed or underappreciated.

For the most part, though, the unit takes pride in its achievements overseas or in training exercises, and learns to resolve issues that are more easily avoided in a 9 to 5 setting. Often junior leaders are given new responsibilities on deployments, giving them and their people more confidence in their abilities to lead in an ambiguous, real world setting.

Challenges to task cohesion

There are number of obstacles that interfere with people's ability to focus on their assigned tasks, work together as a team, and perceive that they are all striving to reach the same goal under competent leadership.

1. Organizational challenges. Some current organizational elements work counter to task cohesion. Increasing specialization and the occupational character of today's army make soldiers at least appear less dependent on one another for meeting group goals. On deployments, soldiers have repeatedly expressed resentment at having to fill sandbags or pull guard duty because these activities are not in their job description. Apparently they miss the larger picture of why everyone needs to pitch in beyond their specialization for the benefit of all. As more and more deployment work is contracted out to private firms (such as engineering, maintenance, laundry, food preparation, janitorial work), soldiers rely on each other less, and come to see each other as separate entities rather than an interdependent whole. Soldiers also lack an understanding of or confidence in how they would integrate on a battlefield, which is relevant because it is not clear whether these contract organizations could be relied upon to carry out these functions in war.

Downsizing has had negative effects on understaffed units. Many soldiers feel overworked and underappreciated. They rarely get to take pride and satisfaction in the work done because there is so much more waiting for them. Those who have to work longer hours sometimes resent their coworkers who arrive at the unit later and leave earlier each morning. This pattern also reinforces the idea that the unit is a worksite where individuals clock in and clock out, rather than a team where everyone pulls together to help each other out.

Research has consistently reported that whether the organization is meeting people's basic needs is crucial to unit cohesion. Some people believe that their needs are not being met, and that they are not a priority to the larger

organization. First, they do not believe they are being adequately rewarded for their efforts, as they watch benefits such as retirement pay shrink at the same time their workload increases. And as Darryl Henderson noted, cohesion suffers as the unit is more often the source of bad news than good, because pay, benefits, passes, and promotions were centralized and taken out of the hands of unit leaders. Second, some people are not even allocated the resources they need to do their jobs properly. When units or members compete against one another for scarce resources such as equipment parts, unit cohesion suffers. The Army must compete with families, college, civilian careers, and other interests that the soldiers may place in priority over the military. To do so, it must enable soldiers to do their jobs, and give them something more for their efforts.

Another current problem harming cohesion is the lack of personnel stability in units. Anna Simons recently detailed the problem of turnover in Special Forces units, who are split up almost as soon as they develop into a cohesive unit. In other types of units, stability is compromised because individuals may be taken from units for deployments or to fill in elsewhere on post. Other individuals are missing because they are attending special schools, or they may be temporarily reassigned elsewhere due to pregnancy or injury. Of course, attrition and transfers must also be factored in. With constant turnover and absence, it can be difficult for the group to gel as a cohesive, reliable work unit.

Unit cohesion is perhaps most challenging for the Army. The Navy has advantage of ship deployment isolation that limits distractions and forces units to work together for long periods. Face-to-face small unit cohesion is probably less of an issue for the Air Force because of the way its power is utilized. The Marine Corps's cohesion is enhanced by its small size and coastal split, because people are much more likely to know each other, serve together, and have similar

experiences because they have served in the same few places Marines are based. Marines are also less specialized and do more of the "tail" work themselves, and therefore may have greater confidence that they can rely on each other to fulfill crucial duties in times of crisis.

2. Generational Challenges. The recent Rand report on gender integration and articles in the Army Times in the past year have pointed to a generation gap, which may cause conflicts that appear along the lines of rank. For example, the younger generations are reported to be more likely to question authority. Their seniors perceive that they come in less physically fit than prior generations, and that their upbringing has given them less in the way of discipline and values.

Younger generations appear to have entered with a stronger sense of "rights" and expectation of privileges than prior generations. What used to be seen as functional hazing and discipline may now be labeled as abuse or harassment. Equal opportunity training has given new soldiers more of a sense of their right to demand a certain level of treatment, and paths for complaint when they believe their rights are being violated. Whereas minorities in previous generations have come from cultures that stress assimilation, current generations value their "differentness" and may perceive pressures to conform as racist or disrespectful of their culture. There appears to be less of a respect for absolute authority conferred by the organization, but a great respect for those whose talents, knowledge, or leadership skills have earned them their position or rewards. Linked to changes in technology, rank relations may become problematic where the younger soldiers are more knowledgeable than their superiors, and older soldiers are technophobic or intimidated by the changes.

Other factors that contribute to this generation gap appear to be linked to soldiers' reasons for joining the Army, which may be more instrumental, and less about patriotism than for previous cohorts. Soldiers are also unlike their

supervisors in that at an early age they are more likely to be married, with or without children, and a significant number are single parents. Living off-post and commitments to family make soldiers less available and less under the influence of their commanders.

The BOSS program has further instilled the sense of soldiers' rights to privacy and "not to be hassled" by their leaders. Notorious is the Army's experiment with "stress cards" at basic training, which many senior soldiers saw as a step too far. Leaders need to be able to push their soldiers to succeed and punish them for violations of the norms. They especially complain that they need to be able to socialize recruits properly at basic training, and that dating, snack machines, video games, and leave during this time are all distractions that add further obstacles to the already difficult task of creating soldiers out of civilians.

The attitudes of younger versus older soldiers will have to be assessed and addressed. Many senior soldiers look down on new recruits with some disdain: they see them as overweight, lazy, undisciplined, and have little respect for them. They may be a bit threatened by younger soldiers too, as the quality has increased so that even among the enlisted there are a considerable number of people with college experience and vocational or technical skills. Junior soldiers are commonly heard complaining about "micro-management," especially on deployments such as the one in Bosnia. They report feeling offended that their chain of command does not appear to trust them to do their jobs right or to stay out of trouble overseas. Smarter soldiers who are willing to challenge their superiors, and superiors who are insecure or hostile to their juniors are potential threats to unit cohesion that will have to be carefully negotiated.

3. Other Demographic Variations. As the participation of minorities and women increase, some leaders have voiced concerns that cohesion will be compromised. As noted earlier, groups can be diverse and still work together

with great success. There are secondary issues related to the management of race and gender, however, which demand attention.

Intimate relationships within a unit can be problematic when the couples are indiscreet or act out their relationship at work, including break-ups. Although relationships within the chain of command are currently prohibited, peer relationships are not. The degree to which peer dating within small work groups is tolerated should be reconsidered, as the detriment to cohesion and morale is apparent to most military leaders who have had to deal with this situation.

If soldiers are to respect and depend upon one another, then double standards have to go. Men and women both have to be pushed to excel, and both need to carry out the functions of their occupation or unit, including the dirty work and the paper work. Anything less causes doubts about the abilities of co-workers, breeds resentment about the unfair distribution of work, and adds to the "specialization" mentality that may cause problems in real times of crisis.

Fear of one's coworkers will also hurt a unit. Given the recent series of scandals, the Army will have to work hard to create a force of men and women who can trust one another not to abuse their authority or resort to false claims of harassment. Victims of harassment need to be assured that the organization will not tolerate such behavior and will respond quickly to their complaints. Those falsely accused need to know that investigations will be fair, and that verifiable false accusations will result in serious disciplinary action for the accuser.

A similar principle applies to race relations. Commanders need to believe that their performance evaluations, if properly supported, will stand up to false accusations of racial discrimination. At the same time the organization must maintain its intolerance of any racist behavior, whether it be discrimination or favoritism.

Finally, the issue of allowing open gays in the military will not likely disappear. If the increase in the public acceptance of gays and lesbians in the last decade is any indication of the future, the next army or the army after next will likely be asked to integrate gays at least to some degree within the ranks. Few military leaders will relish the task, but it would be prudent to draft a plan of at least partial accommodation, or commission research to examine the impact of the presence of open gays on unit performance.

Some Additional Notes On Controlling Social And Task Cohesion

Diversity in the U.S. Army, if managed properly, can be an asset for the formation of task cohesion and prevention of some of the negative effects of social cohesion. A diversity of backgrounds and opinions helps members of a unit develop creative solutions to problems and gives them a wider range of experiences to draw upon. Furthermore, diversity helps prevent groupthink. Our unique mixed-race mixed-gender composition likely contributed to our troops' abilities to keep excessive force against locals in Somalia under better control than more homogenous countries' units (Miller and Moskos 1995). As noted earlier, however, diversity can be a liability if mismanaged. Overt dating among co-workers and double standards by race or gender can undermine a unit's ability to achieve task cohesion.

Janis presents a number of suggestions about how to limit social cohesion even in homogenous groups such as much of today's infantry, artillery, armor, and Special Forces units. For example, just being aware of the tendency for cohesive groups to make premature, faulty conclusions can assist leaders in making sure they explore many options, and the pros and cons of each, before making a decision. Additionally, a commander can rotate the assignment of the role of devil's advocate among individuals, so that someone's job is to present contrary opinions without the risk of personal censure by the group.

Although coping with hardship promotes task cohesion, attempts to create unnecessary hardship can backfire. During the first deployment of soldiers to Haiti, many of the troops were angry about the limited availability of "real food," given the proximity of Florida. This was interpreted by some soldiers as evidence of incompetence on the part of the Army logistics, and by others as lack of leadership concern for the common soldier. A few leaders expressed the view that hardship would toughen up the troops, but few troops saw it that way. The reality of the food situation may have been unrelated to goal of toughening up or bonding soldiers, but this case can serve as evidence to the response such a policy might provoke. Darryl Henderson also noted that American troops view a high level of material support as evidence of their military's superiority, and may interpret a drop in standards as a signal of organizational problems.

Some leaders may attempt to foster unity in the form of competition with other units. This indeed can help improve the morale and cohesion -- of the units who win. "Crackerjack" or elite units gain a good deal of task cohesion based on their perception that "they do it best." The units who must work in their shadow, however, sometimes report discouragement and alienation from other soldiers whom they should view as partners. Perhaps there are ways that commanders can foster competition with the units' prior work levels or achievements so that all units are encouraged toward continued improvement.

As a final point, the Army might want to reconsider how it distributes information in the Army After Next. With an increasingly smarter and professional force, smaller and more quick and agile on the battlefield, soldiers at all levels will need to be informed to a degree that may not have been necessary in the past. Individuals are increasingly placed in positions where the decisions that they make could have international consequences. Across several peacekeeping missions, soldiers have repeatedly asked for greater political, social, and cultural

information to help them judge how they should behave in a tense situation, such as those that sometimes arise at checkpoints. Fostering an interdependence upon one another for information and allowing such information to flow even to the youngest private may be an important way both to bring units together and to maintain a superior "supersmart" force in the field.

Conclusion

This paper has focused on the distinctions between social and task cohesion, and has pointed out some of the reasons that social cohesion needs to be limited. It has also discussed some of the current challenges to task cohesion confronting the Army After Next, and suggested some directions for meeting these challenges. Of course many of these problems are not solved easily. The overriding goal must be to create units whose members can rely on one another and work well together to present a formidable opponent on the battlefield.

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Fostering Military Team Adaptiveness in the Army After Next

Stephen J. Zaccaro
George Mason University

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Introduction

The operating combat environment for the U.S. Army in the first quarter of the next century is likely to be characterized by high information load and increased velocity, requiring more rapid responses by military commanders and their units. Improvements in weaponry and information technology have resulted in a new context for the future battlefield. For example, technological advancements have created exponential increases in the data flowing to unit decision makers. New communication technologies have also multiplied the number of input channels to commanders. Further, military units will be required to operate in greater isolation and with more autonomy. To be effective, then, Army leaders and their units will need to be highly cohesive and resilient under extremely complex and stressful operating conditions.

Successful military performance depends *jointly* upon effective team and leadership processes. Indeed, dynamic and structural properties of the team are likely to mediate the influence of leader characteristics and behaviors on unit performance. These points suggest two important questions:

- What factors contribute to the nature of team effectiveness, particularly under conditions of high complexity and adversity; and
- How are leadership and team processes integrated to enhance collective success under these conditions.

Surprisingly, there has been relatively little attention paid specifically to either of these questions in the psychology literature on teams and leadership. For example, there is a significant body of work on how stress and adversity influence team performance (e.g., Argote, Turner, & Fichman, 1989; Gladstein & Reilly, 1985; Isenberg, 1981; Kelly & McGrath, 1985); however, there are few if any studies on how teams can thrive under stressful conditions (see exceptions by Hall, Wolpe, Cannon-Bowers, 1992; Zaccaro, Gaultieri, & Minionis, 1995).

Given the foreseeable changes in the operating environment of Army units in the 2025, team capabilities that foster adaptiveness to adversity and complexity will become a critical issue for the Army After Next (AAN). The purpose of this paper is describe a number of factors that contribute to unit effectiveness and adaptation to adversity. This paper also describes how leaders influence these factors and promote team adaptiveness. These contributions are followed by a brief set of recommendations for Army leader and unit training.

Components of Team Effectiveness

Most conceptual descriptions of teams emphasize that team members typically have different and unique roles, each representing critical contributions to collective action (e.g., Salas, Dickinson, Converse, & Tannenbaum, 1992). Thus, there exists a high degree of interdependence among team members that requires coordination and integration of their contributions to achieve team goals. Successful team action under any environmental circumstance, then, requires (a) the identification of appropriate individual member contributions and (b) and a plan for the best way these contributions can be combined into an integrated team response (Hinsz, Tindale, & Vollrath, 1997). Team leaders are typically tasked with these requirements.

Another essential element in conceptual models of team effectiveness is that team interaction is expected to be *adaptive* with respect to environmental conditions. In essence, truly effective teams are those that are able to maintain high levels of collective performance, even as team and environmental circumstances become decidedly adverse. This often requires that teams develop norms and operating procedures that promote individual and collective flexibility. Developing the conditions of team adaptability is another essential leader function, particularly in young or inexperienced groups (Kozlowski, Gully, Salas, & Cannon-Bowers, 1996)

Team effectiveness emerges from a combination of certain *motivational*, *cognitive*, *affective*, and *coordination processes* (Marks & Zaccaro, 1997). When military teams can maximize each of these processes, they are better able to respond expeditiously and effectively to fast changing environmental conditions.

Motivational Processes:

Team effectiveness is grounded in members being motivated to work hard on behalf of the team. This motivation derives in part from (a) the cohesion of the team, (b) its sense of collective efficacy, and (c) the development of a normative system in the team that fosters a strong collective work ethic.

Group cohesion: Group cohesion reflects the degree of commitment team members have made to each other and to the team as whole. This commitment can have either (or both) a social focus or task focus (Carron, 1982; Tziner, 1982; Zaccaro, 1991). Social cohesion represents the intensity and number of friendships among members of the group (Festinger, Schachter, & Back, 1950). Task-based group cohesion results when task accomplishment provides for both the personal and collective attainment of important goals (Festinger et al., 1950). This latter type of cohesion occurs from the necessity of individuals to work together to achieve desired outcomes when such outcomes are unattainable through individual achievement (Tziner, 1982).

In task-cohesive groups, members care about the success of other group members because their personal goal attainment is often inextricably bound to collective achievement. That is, their personal goals become tied to the team's goals. Accordingly, team members will exert strong effort on behalf of the group and their fellow members to facilitate group success.

More importantly, when faced with adversity or possible failure, members of high task-cohesive groups (a) are likely to be more committed to the task and devote more effort to its accomplishment; (b) set and enforce more stringent performance norms that compel such effort (Zaccaro & McCoy, 1988); (c) plan more efficiently and develop more appropriate performance strategies (Hackman, 1976; Hackman & Morris, 1975); and (d) persist at the task, even in the face of continuing or growing difficulty. For these reasons, Army units in the environment of AAN will need to emphasize the development and maintenance of strong task-based cohesion.

Collective efficacy: High cohesiveness is likely to be a function of members' beliefs that, together, they can effectively accomplish the tasks they need to for their team to be successful. Such beliefs have been labeled *collective efficacy* (Bandura, 1986), and defined as a team property that reflects the members' confidence that collectively they can perform a particular task or mission well (Zaccaro, Blair, Peterson, & Zazanis, 1995). As members feel more confident of their team's capabilities, they are more motivated to work hard for the team, persist in the face of collective obstacles, and are willing to accept more difficult challenges. Such teams also set more difficult goals and are more committed to these goals (Weldon & Weingart, 1993). Consequently, under extreme adversity, highly efficacious teams should perform better than groups having low collective efficacy.

Why does collective efficacy facilitate team adaptation? Strong collective efficacy helps teams adapt to adversity by increasing the correspondence between team communication patterns and team performance. That is, in highly efficacious teams, communications among team members are more closely attuned to what is occurring in their operating environment (Zaccaro, Parker, Burke, & Higgins, 1997). Accordingly, they can alter their actions and performance patterns more quickly when environmental conditions change.

Recent research that examined efficacy beliefs in an Army command and control team found evidence for its utility in team adaptation (Marks, Mathieu, & Zaccaro, in preparation). During a training exercise, this team completed two performance simulations, the second one more complex than the first. Members who had strong efficacy beliefs outperformed those with low efficacy beliefs on the more complex exercise; in the more routine exercise, the effects of such beliefs were minimal. Thus, the effects of efficacy beliefs become more potent when performance conditions became

more complex.

High collective efficacy does not always help adaptation. Some teams with strong efficacy beliefs may react with overconfidence when required to perform in novel circumstances. They do not take the time to understand the new performance requirements of their situation and respond with familiar, but useless, actions. This effect is less likely to occur in highly experienced teams whose efficacy beliefs are grounded in a series of successes under such circumstances. Thus, team training should focus on fostering a *realistic* sense of efficacy that aids, not hinders, team adaptation to novel environments. This emerges when team members train together for a long period of time and build a history of shared experiences.

Performance norms. Both task-based cohesion and collective efficacy are associated with strong work norms. Some groups establish a climate that compels hard work from their members. Norms develop in such groups that call for strong effort and higher performance from all group members. Once established, these norms are enforced by the members themselves; when deviations occur, members will communicate in various ways with the nonconforming individual to bring him or her in line with group work expectations (Festinger, et al, 1950).

Cognitive Processes

Team effectiveness requires that team members first make the choice to allocate collective attention and member cognitive resources to task accomplishment. Then, members need to determine how to allocate these resources and their efforts among performance requirements (Kanfer & Ackerman, 1989). These decisions reflect cognitive processes that are linked to team task accomplishment.

The strongest cognitive influence on team coordination and performance is the collective information processing that occurs when teams confront task and problems situations. A complete review of group information processing models is beyond the scope of this paper; interested readers are referred to Hinsz, et al. (1997). However, some basic processes include:

- developing a shared understanding of team problem parameters and processing objectives,
- utilizing individual and shared knowledge structures to define solution alternatives,
- evaluating and reaching consensus on an acceptable solution,

- planning and implementing actions that form the chosen solution, and
- monitoring the implementation, outcomes, and consequences of chosen solution.

The successful accomplishment of these processes is important for team performance in complex environments. The critical task, however, is to engage in these processes, even when the pace of time and velocity of action increases dramatically. Research has shown that under temporal urgency, teams will forego some of these processes, to their detriment. For example, decision making under stringent time parameters typically results in (a) devoting less time to information acquisition and processing, (b) insufficient planning and evaluation of decision or solution options, (c) failure to monitor member actions adequately and make necessary response adjustments, and (d) narrowing control over decision making to fewer participants (Argote, et al., 1989; Gladstein & Reilly, 1985; Staw, Sandelands, & Dutton, 1981). These responses to temporal urgency can increase the uncertainty and the sense of threat confronting Army units in such situations, resulting in a further deterioration of performance. Because the speed and velocity of battle is expected to increase exponentially in the AAN, Army units and their commanders need to know how to engage in critical information processing, even when time parameters are very short.

One way of decreasing the time needed for team information processing is to develop among unit members, well-organized shared knowledge systems, or *team mental models*, that contribute to more integrated actions (Hinsz, et al., 1997; Klimoski & Mohammed, 1994). Team mental models encode the knowledge and understanding members have about the mission of their team and its parameters, as well as the various roles/behavior patterns required of individual members to successfully enact collective action. When team members possess common understandings of team performance requirements, they are better able to anticipate each other's actions and reduce the amount of processing and communication required during team performance.

What kinds of mental models are important for team coordination and adaptation? Research has suggested four basic team mental models (Cannon-Bowers, Salas, & Converse, 1993). One includes knowledge about the equipment used by the team to (a) acquire information from its environment; (b) monitor its own functions; and, of course, (c) perform its collection actions (*equipment model*). Another model contains knowledge about the purpose and mission of the team and more specifically the task requirements related to this mission (*task model*). This model includes task procedures, tactics, strategies, and how the task is likely to change in response to environmental contingencies. A third model represents knowledge about team member characteristics, including their task knowledge, abilities, skills, attitudes, preferences, and tendencies (*team model*). The fourth model encodes information with respect to the individual and

collective requirements for successful interactions among team members (*team interaction model*). This model describes how members are supposed to interact with one another during various phases of the task. They also need to know "when to monitor their teammates' behavior, and when to step in, and help a fellow member who is overloaded, and when to change his or her behavior in response to the needs of the team" (Cannon-Bowers et al., 1993, p. 232).

These models provide a base of common understanding in military units about how team members are to respond together to task and environmental conditions. Team mental models help teams adapt in two ways. First, such knowledge representations include information about how members should change their ways of acting when environmental events change. Thus, soldiers in units who share well-developed understandings about how they need to act under adversity, will adapt more effectively those soldiers who do not have such common knowledge.

Such mental models are sufficient when teams can anticipate changing events. When units need to confront relatively novel situations, this information may not be directly useful. However, the second way that mental models help teams adapt is by providing analogies used to reason new task strategies when facing novel problems (Holyoak, 1984). That is, information about how military units acted previously in similar situations can help them develop actions when put into a situation that is less familiar to them.

Affective Processes

Team effectiveness is also determined by the affective climate within the team. A positive mood among team members will foster more cooperation, more participation, less conflict, and stronger social cohesion (Carnevale & Isen, 1986; Rhoades & O'Connor, in press; Rafaeli & Sutton, 1989). Collective negative moods result in more internal conflict and less willingness by team members to work with each other, i.e., participate in team activities (Rhoades & O'Connor, in press). The result is the impairment of motivational and coordination processes in teams and lower group performance (George, 1990). Affective climate also affects group information processing. Collective positive mood increases the amount of information that is processed in teams, as well as the creativity of member contributions (Rhoades & O'Connor, in press).

These observations are not meant to convey that conflict in groups is unproductive. A difference can be established between cognitive and affective conflict (Amason, 1996). The former refers to conflict among team members that "is generally task-oriented and focused on judgmental differences about how to best to achieve common objectives", while affective conflict "tends to be emotional and focused on

personal incompatibilities or disputes" among team members (Amason, 1996, p. 127, 129). Amason found that cognitive conflict in 48 top management teams was positively associated with quality, understanding, and acceptance of team decisions; affective conflict impaired team decisions. Teams, then, need to establish the basis for constructive cognitive conflict (when appropriate, given time parameters and the need for respect for command), without fostering other more destructive forms of conflict.

As team environments become more aversive (i.e., more time-urgent, stressful, complex, ambiguous), team members obviously need to maintain a collective calm. If the team succumbs to stress, member interactions become more narrowly focused among a subset of the team, information becomes increasingly less shared among team members, decision alternatives are not fully explored, and decision making accuracy declines (Argote, et al., 1989; Gladstein & Reilly, 1985; Isenberg, 1981). Likewise, members become less committed to collective decisions (Frye & Stritch, 1964). Teams are not likely to be able to avoid environmental stressors; to be effective they need to develop collective coping mechanisms that fostered continued effectiveness, even under stress.

Coordination Processes

Team effectiveness depends fundamentally upon how well team members can work together, integrating their individual actions. Effective team coordination requires that members accomplish the following sets of activities, individually and as a team (Fleishman & Zaccaro, 1992):

- *Team Orientation:* exchange information about task goals, situational contingencies and constraints, and member resources that can be directed at task accomplishments
- *Resource distribution:* assign team members to specific tasks during collective action, taking care to balance work load appropriately across members; shift role and task assignments in response to changing environmental and team conditions.
- *Work Timing:* coordinate and regulate the pacing and speed of task accomplishment by different team members.
- *Response sequencing:* sequence member activities and time their occurrence relative to the occurrence of other team actions.
- *Motivational enhancement:* procure the commitment of individual members to working as a team, and to work hard on behalf of the group.

- *Action monitoring*: attend to and correct errors that occur in the nature and timing of member activities.
- *Procedure maintenance*: Monitor and ensure ongoing compliance with established performance protocols and standards.

To be effective, these team coordination functions need to become fairly automatic behavior patterns displayed by team members, individually and collectively, as teams confront tasks. Alternatively, if teams need to operate in highly dynamic and complex conditions, then how members apply these functions needs to be adaptive.

In essence, Army units need to balance two countervailing necessities in such environments: (a) the need to standardize how team members contribute and combine their resources, and (b) the requirement that they remain flexible as task conditions become more dynamic. This balance is created through *regulatory mechanisms* established within the team. These mechanisms refer to operating procedures developed to govern the activation, occurrence, intensity, and monitoring of team performance functions. These procedures become encoded in team mental models and new members are socialized to adopt and accept these procedures. Examples of such mechanisms include team performance norms, communication rules, and trained strategies shared by team members about how to accomplish routine team functions.

A important consideration in teams that are effective in dynamic environments is that regulatory mechanisms have "built-in" operating procedures that promote adaptability. For example, team members may establish different communication and decision making rules that are triggered by certain crisis situations. Likewise, team strategies may be encoded that specify how team member roles are to change as performance situations change.

Team Boundary Spanning

Sundstrom, De Meuse, and Futrell (1990) defined team effectiveness as the extent to which the team can meet the performance expectations of external stakeholders and constituencies, while maintaining effective internal dynamics. This perspective places a premium on the team's "boundary spanning" activities as a critical aspect of team effectiveness. Teams need to be attuned to their environment in order to understand and respond to the expectations of their external constituencies. Indeed, teams need to establish specific roles, in which members are primarily tasked with attending to the these constituencies and helping their teams stay aligned with them (Ancona & Caldwell, 1988).

In most teams, these roles are typically assigned to the designated leader of the

team. This is perhaps the most important means by which leaders influence team effectiveness. However, leadership roles also involve the facilitation of the motivational, cognitive, and coordination processes necessary for the team to be successful. In addition, leaders need to promote an affective climate in the team that fosters constructive conflict (if necessary) and calm in the face of adversity. Thus, team leadership is a critical determinant of how effectively the team responds to its challenges

Leadership and Team Effectiveness

Although, the skills and actions of a team leader are important determinants of team effectiveness, there are few conceptual models of how leadership processes lead to team effectiveness (see exceptions by Hackman & Walton, 1986, Kozlowski, et al., 1996). One perspective of leadership, the *functional leadership approach*, specifically addresses in broad terms the leader's relationship to the team (Fleishman, et al., 1991; Hackman & Walton, 1986; Lord, 1977). As described succinctly by Hackman and Walton (1986, p. 75),

The key assertion in the functional approach to leadership is that "<the leader's> main job is to do, or get done, whatever is not being adequately handled for group needs" (McGrath, 1962, p. 5). If a leader manages, by whatever means, to ensure that all functions critical to both task accomplishment and group maintenance are adequately taken care of, then the leader has done his or her job well.

This perspective defines leadership as focused on facilitating unit goal attainment, where leaders are responsible for (a) diagnosing any problems that could potentially impede group and organizational goal attainment, (b) generating and planning appropriate solutions, and (c) implementing solutions within typically complex environments (Fleishman, et al., 1991; Zaccaro et al., 1995). This definition offers several critical distinctions regarding team leadership. First, it emphasizes leadership as a boundary role linking teams to their broader environment (Katz & Kahn, 1978). Thus, Army commanders are typically responsible for learning developments and events outside of their unit. Further, they are also responsible for interpreting and defining environment events for the team.

The second distinction is that leadership typically involves discretion and choice in what solutions would be appropriate in particular problem domains. Team actions that are completely determined by the situation do not require extensive decision making by unit leaders. Leadership is most necessary for team problems in which multiple solutions are viable and/or requisite solutions need to be implemented in complex circumstances. Unit leaders, then, are responsible for making the choices that define subsequent team responses.

A third distinction is that functional leadership is not defined by a specific set of behaviors but rather by more general patterns that are prescribed for, and will vary across, different problem situations. That is the emphasis switches from "what leaders *should do* <to> what *needs to be done* for effective performance (Hackman & Walton, 1986, p. 77). This distinction separates functional leadership perspectives from other models of leader-team interactions that either (a) specify particular leadership behaviors (e.g., task-oriented, relationship-oriented) considered to be optimal in most team situations (Blake & Mouton, 1964; Fleishman, 1953; Likert, 1961), or (b) would vary in application according to specific team properties and situational characteristics (Fiedler, 1964; Kerr & Jermier, 1978). Instead, leadership is defined in terms of problem solving activities directed at the generation of solutions that advance team goal attainment.

Leadership and Team Motivation

A central responsibility of unit leaders is to motivate and energize the soldiers under their command to work hard on behalf of the unit (Jesuino, 1996). One fundamental approach is to raise the unit's collective efficacy of the team. If soldiers believe their unit is capable of accomplishing its mission successfully, they are more likely to work harder (Zaccaro et al., 1995). Bandura (1986) suggested that efficacy beliefs emerge in part from (a) a history of successful achievement, (b) observations of modeled behaviors that lead to successful performance, and (c) persuasion and social influence processes. Effective leaders will use these strategies to build task confidence in their units (Gist & Mitchell, 1992; Kozlowski, et al., 1996). They model appropriate task strategies, allowing newly developing teams (or new team members) to acquire collective task competencies. They also model teamwork, or how team members should work together. By their actions, such leaders establish the acceptable interaction patterns in the team. If they model and promote idea exchange, constructive criticism and mutual support, the team is likely to feel more efficacious with respect to its assigned tasks.

Team efficacy also emerges from leaders who exhort their members to work hard and do well. This is related to the empowerment processes of transformational and inspirational leaders (Bass, 1985; Burns, 1978). By their actions (see Bass (1985) House, (1977) and House & Shamir, (1993) for a delineation of these actions), such leaders fuse each member's personal goals with the team or organizational mission. Team members identify at a personal level with the mission of the unit as a whole and are therefore more committed to its accomplishment (House & Shamir, 1993).

Leadership and Team Cognition:

Effective team coordination, decision making, and performance means that team members must have an accurate shared understanding of their operating environment and how, as a team, they need to respond. A major responsibility of the unit commander is

to facilitate this collective understanding. There has been little, if any, research linking team leadership to the development of effective team mental models. However, shared mental models of expected team and member actions serve as key mechanisms by which leaders structure and regulate team performance. Effective leaders develop in team members an understanding of the team's mission, the action steps necessary to complete the mission and the role requirements for each member in collective performance. In essence, team leaders convey their own understandings and mental models of the problem situation as derived from their environment spanning activities. Thus, leadership processes and the quality of a team leader's mental models become key determinants of subsequent team mental models.

This argument suggests a process of leader-team performance that begins with the development of a leader's mental representation of a problem situation. This mental model reflects not only the components of the problem confronting the team, but also the environmental and organizational contingencies that define the larger context of team action. Here, the leader develops a model of what the team problem is and what solutions are possible in this context, given particular environmental and organizational constraints and resources. This problem model then drives the development of a team interaction model that encodes how the team ought to respond to the problem situation. The leader forms this second model from his or her understanding of team capabilities and the resources of individual team members in the context of the problem at hand (Zaccaro, et al., 1995).

The next step in this process of leader-team performance is the communication of the leader's mental model of team action to team members. This step is a critical one for unit commanders because if they develop a perfect plan for team problem solving, but cannot communicate the model or plan effectively to the team, then the team response will be inadequate. If this communication is successful, team members form and share an accurate model of expected behaviors and role requirements in accordance with their assigned mission and the problem they need to confront (Marks, 1997).

Another influence of leadership on team cognitive processes is to facilitate the information processing activities engaged by the team as it accomplishes its task. Indeed, the leader will often "take over" several of these processes, including problem construction, the definition of solution alternatives, and implementation planning, especially early in the team's development. However, this does not obviate other team members from these responsibilities. Indeed, in constructing team problems, deriving solutions, and planning their implementation, team leaders draw heavily on the functional expertise and diversity within the team. In effect, they coordinate the contribution and combination of team knowledge and information resources; where "gaps" occur, they make interpretations and decisions that move the team along (Hinsz, et al., 1997; Kozlowski, et al., 1996).

One of the most critical leadership influences on the cognitive processes underlying team effectiveness is to foster collective "metacognitive" processing in the team, especially after major task engagements (Kozlowski, et al., 1996). Metacognition refers to reflection upon the cognitive processes used in problem solving; in essence it represents "knowledge and cognition about cognitive phenomena" (Flavell, 1979, p. 906). Sternberg and his colleagues also define metacognitive processes as executive functions that control the application and operation of cognitive abilities and skills (Davidson, Deuser, & Sternberg, 1994; Sternberg, 1985).

To achieve a high level of expertise that promotes adaptation in a dynamic operating environment, team members need to set aside time to consider, individually and collectively, the consequences of their strategies, how they considered and arrived at a team solution, and how they worked together to implementation selected solutions. This is a difficult process to initiate and to complete successfully. When teams have succeeded at a task, members may not see the need for reflecting upon collective information processing and interaction patterns; likewise, when they fail, they are more likely to engage in such reflection, but it may be focused on "fixing blame", with negative consequences for subsequent team cohesion and efficacy. The unit leader needs to manage this process so that it occurs when necessary, and it is a constructive exercise that strengthens the team.

Leadership and Team Coordination

Leadership influences on the development and maintenance of successful team coordination processes can be characterized in several stages (Kozlowski et al., (1996). First, leaders need to facilitate the identification and combinations of contributions from team members that are most likely lead to task success. This means developing their own as well as the collective awareness of what resources are available to the team. This identification is followed by the unit commander developing a plan that effectively combines and integrates these resources. Then, leaders need to provide training, instruction, and opportunities for team members to learn the roles and tasks that need to be integrated into effective teamwork. The focus is not as much on learning individual roles, but rather on developing the interaction patterns necessary for team success. Finally, the team leader needs to facilitate the development of mechanisms that regulate and standardize these patterns. Ideally, once these are established, they are reinforced by the team members themselves as they monitor their joint actions.

These steps produce regulated coordination patterns in the team. However, they do not necessarily foster team adaptation; indeed, they may cause the team to become more rigid in its responses within a quickly changing environment, particularly if these patterns were successful on earlier tasks. When team complexity increases to the point where established interaction patterns are not sufficient for success, the team leader needs

to reconsider team resources, recombine them into more viable coordination patterns, and reorient team regulation mechanisms (Kozlowski, et al., 1996). Also, to facilitate team adaption, team leaders need to promote the display of flexibility and creativity among team members albeit within the confines of team task requirements and environmental conditions.

Leadership and Team Boundary Spanning

As teams become highly expert and effective, leadership functions become increasingly shared across team members. However, in hierarchically-organized teams, the designated leader will retain a major responsibility for team boundary spanning. The leader is the major, and often the only, link between the unit and its strategic environment (Katz & Kahn, 1978). Thus, unit commanders need to help their units set performance objectives that are aligned with the strategic requirements operating in the combat environment. They need to coordinate their team's acquisition of necessary resources. They also need to provide feedback and situation assessments to their teams, so that team members can see the relationship between their collective actions and changing environmental conditions. As the internal processes of the team become more proficient and adaptive, these functions are likely to become the major portion of the unit leader's responsibilities (Fleishman, et al., 1991; Kozlowski, et al., 1996).

Summary: Implications for Military Training

In this paper I have specified a number of fundamental components of team effectiveness and adaptation. These were succinctly categorized in terms of motivational, cognitive, affective, and coordination processes. In essence, Army units can adapt more readily to adversity when:

- They have high levels of task cohesion.
- Their members share strong collective efficacy beliefs.
- They establish high performance norms.
- They engage in collective information processing without short-circuiting critical steps.
- They engage in collective reflection of their performance actions (i.e., "after action reviews").
- They avoid affective conflict while establishing norms that foster constructive idea exchange.

- They develop regulatory mechanisms that establish strategic and tactical contingencies for team action.

Unit leaders facilitate team adaptation by fostering the development of these processes among the soldiers under their command. For the Army After Next, leaders will need to understand the various team processes contributing to team adaptation. They will need to know how to create the right combination of these processes in their unit. These leadership requirements put a premium on the development of leader social reasoning skills and interpersonal competencies (Zaccaro, 1996). It also suggests that officer training should focus more strongly on how to develop team processes that help units thrive under adversity.

This also suggests some important shifts in the focus of team training. Existing team training approaches tend to emphasize the development of taskwork skills, where team members learn how to accomplish certain maneuvers and tactics together. However, to become more effective as a unit, members also need focused and specific training on the development of teamwork skills, where they learn how to communicate, interact, and implement decisions together (McIntyre & Salas, 1995; Salas, et al., 1992). Guidelines for the development of such training strategies already exist (Cannon-Bowers, Tannenbaum, Salas, & Volpe, 1995; Swezey & Salas, 1992). They need to be integrated into future efforts.

It is axiomatic that in the military, training is typically conditioned by prior combat experiences; that is "the military is fighting (and therefore training for) the last war." This focus can impede the training and development of adaptive mechanisms in teams. Future training efforts will need to emphasize more strongly team adaptability and flexible responsiveness. How this can be done is still not entirely clear. However, recent research with Navy units, where issues of teamwork have been more prominent, has illustrated the utility of training interventions that foster team self-correction processes (Blickensderfer, Cannon-Bowers, & Salas, 1997). Such processes promote team adaptation by helping teams to alter their existing interaction patterns in response to performance errors. These and other training protocols that emphasize team adaptability (e.g., Cannon-Bowers, et al., 1995; Entin, Serfaty, & Deckert, 1994) need to be examined more closely for their possible inclusion in future Army training efforts.

The processes that foster team adaptation are more likely to emerge if units train together, with their commanders, over a long period, sharing many experiences. Indeed, the recent annual report on the Army after Next Project noted (U.S. Army, Chief of Staff, 1997):

Soldiers who train together for long periods tend to adopt a shared view of the battlefield, to include their environment and their unit's ability to

respond to specific combat challenges. This shared view allows leaders, peers, and subordinates to act effectively, with little or no communication, even in rapidly changing situations. Likewise cohesive units offer the Army, a greater reservoir of psychological resilience --a safety net--that offsets, to a great degree, battlefield fear, fatigue, stress, and isolation. Such units remain mentally agile even under severe circumstances. They require less supervision, handle complex tasks effectively, and exhibit mutual trust, confidence and loyalty (p. 23).

Team cohesion, realistic collective efficacy, shared mental models, and adaptive coordination mechanisms all emerge from extensive experiences in multiple performance environments. When unit membership continually changes and leaders are rotated out, then the unit needs to spend an inordinate amount of time redeveloping key adaptation processes. Thus, future Army training efforts need to consider ways of increasing intact team training interventions that emphasize a long shared history of taskwork and teamwork experiences. The goal of these efforts should be to develop highly effective units that can adapt readily to the more complex combat environment characterizing the Army After Next.

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